CHAPTER 4

CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

INTRODUCTION

Potential direct, indirect, and cumulative impacts of the Proposed Action and Alternatives are described in this chapter. Construction, operation, and reclamation of the Leeville Project and alternatives identified in Chapter 2 would result in irreversible and irretrievable commitments of resources, residual adverse effects, and cumulative impacts to the environment. Irreversible commitments of resources are those that cannot be reversed, except over a very long period of time. Irretrievable commitments of resources are those that are lost. Residual adverse effects are those effects that remain after completion of the Proposed Action and implementation of mitigation measures. Cumulative impacts are those impacts on the environment that result from incremental impact of the action when added to other past, present and reasonably foreseeable future actions.

BLM has analyzed potential impacts that could result from the Proposed Action and the following alternatives:

- No Action Alternative;
- Alternative A – Eliminate Canal Portion of Water Discharge Pipeline System;
- Alternative B – Backfill Shafts; and,
- Alternative C – Relocate Waste Rock Disposal Facility and Refractory Ore Stockpile.

Potential mitigation measures address the Proposed Action and Alternatives and have been identified in each resource description contained in this chapter for which a potential impact is described. Mitigation measures proposed by Newmont are summarized in Chapter 2. Impacts associated with implementation of these mitigation measures are included in the analysis of impacts described in this section. Additional mitigation and monitoring measures can be required by BLM as a condition or stipulation of approval for authorization of the Plan of Operations.

CUMULATIVE IMPACTS

Cumulative impact as stated in 40 CFR 1508.7 "… is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency [Federal or non-Federal] or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time . . .."

Results of cumulative impact analyses determine whether an action contributes significantly to impacts associated with other activities in the area, or results in significant impacts when added to other activities. Cumulative impact analyses do not consider potential mitigation for reasonable foreseeable actions.

The geographic cumulative impact area referred to in this section varies depending on the resource being discussed. **Figure 4-1** depicts the general area for most resources for which cumulative impacts have been evaluated. The Carlin Trend, an area of intense mine development, is the central feature of the cumulative impacts area. The area is generally bounded on the northwest by the Ivanhoe Mine and on the southeast by the Emigrant Mine.

Mine development in the Carlin Trend has principally affected distribution and occurrence of groundwater and surface water in the cumulative impacts area. In addition to the

Leeville Project, other mine activities may be proposed in the area. Potential cumulative impacts that may occur from mine dewatering and water management activities in the Humboldt River basin were analyzed separately in the report, *Cumulative Impact Analysis of Dewatering and Water Management Operations for the Betze Project, South Operations Area Project Amendment, and Leeville Project* (BLM 2000a). That document was used as a foundation for the cumulative impacts analyses presented herein.

Cumulative impact analysis included in this section is based on an 18-year life-of-mine for the Leeville Project. Cumulative or additive impacts will therefore be described for reasonably foreseeable activities through 2020.

Past and Present Activities

Mining and livestock grazing have been and continue to be dominant land use activities on private and public land in the cumulative impacts area. Ranching activities include development of springs and groundwater resources for livestock watering, fencing, installation of windmills, development of irrigated pasture, and diversion of groundwater and surface water for irrigation. Livestock grazing has been excluded from most mining areas.

Mining activities in the cumulative impacts area include exploration (drilling, trenching, sampling), development of underground mines, open-pit mining, waste rock disposal, ore milling and processing, tailing disposal, heap leaching, dewatering/discharging, and reclamation. Historic mining activity is discussed in Chapter 2.

New or upgraded power lines have been constructed in the cumulative impacts area to supply energy for mining activities. Access roads constructed along power line corridors facilitate inspection and construction.

Reasonably Foreseeable Activities

Reasonably foreseeable activities within the cumulative impacts area include mine development, mineral exploration, mined-land reclamation, livestock grazing, wildlife habitat restoration, transmission line and substation construction, and aquatic habitat restoration. These land uses are expected to continue into the future at varying levels of activity.

Mining Activities

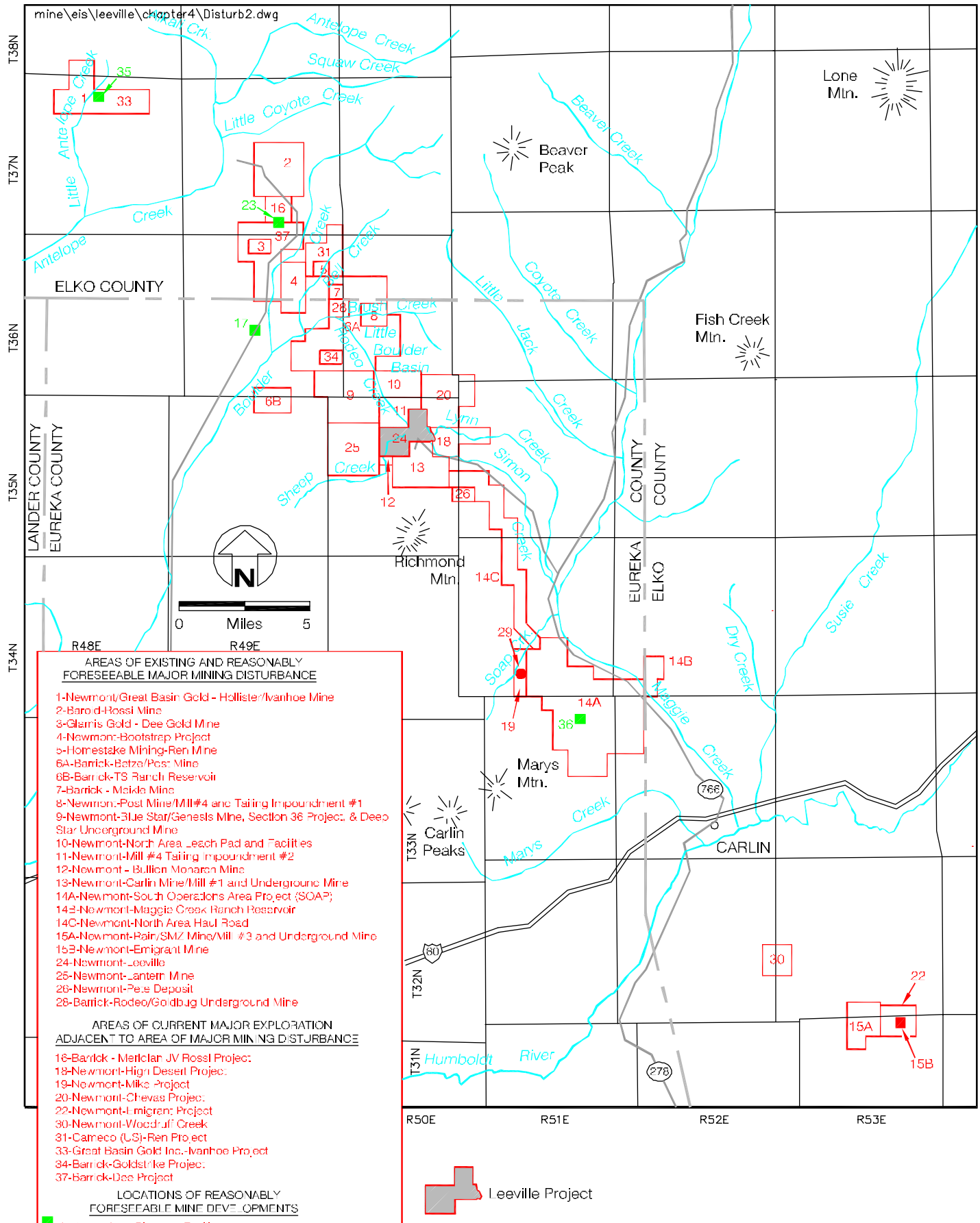
Mining is expected to continue as a major activity in the Carlin Trend. **Figure 4-1** shows locations of existing and reasonably foreseeable mining and exploration sites in the Carlin Trend.

The boundaries shown on **Figure 4-1** for the mining operations delineate areas where disturbance has occurred or is expected to occur. These boundaries represent the outer limits of major surface disturbance but do not imply that all the area within the boundaries would be disturbed. Acreage for existing and reasonably foreseeable mining disturbances are listed on **Table 4-1**.

Disturbances related to mine development include mine pits, processing facilities, heap leach pads, waste rock disposal facilities, tailing impoundments, haul roads, and administrative offices. Exploration on undisturbed land is not necessarily included within boundaries shown on **Figure 4-1**. Acreages of open-pit disturbance not scheduled for reclamation are listed in **Table 4-2**.

Existing mines are shown on **Figure 4-1** and details regarding these mines are presented in **Table 4-1** and **Table 4-2**. The Goldstrike Property is currently undergoing environmental review for dewatering and water management operations. The Goldstrike Property consists of the Betze/Post open pit mine and the Meikle underground mine. Exploration projects anticipated to be developed as mining projects in the near future are shown on **Figure 4-1**.

The largest mine dewatering program in the North Operations Area occurs at the Goldstrike Property where current dewatering rate is approximately 40,000 gpm, but varies seasonally. Dewatering is expected to continue at decreasing rates until year 2011 (**Figure 3-7**). Water from the Goldstrike Property dewatering system is pumped to Boulder Valley where it is infiltrated, injected, and/or used for irrigation. A large portion of water that infiltrates into the basin from the TS Ranch Reservoir reappears as three spring complexes approximately 5 miles south of the reservoir.



AREAS OF EXISTING AND REASONABLY FORESEEABLE MAJOR MINING DISTURBANCE

1-Newmont/Great Basin Gold - Hollister/Ivanhoe Mine
2-Barrick-Rossi Mine
3-Glamis Gold - Dee Gold Mine
4-Newmont-Bootstrap Project
5-Homestake Mining-Ren Mine
6A-Barrick-Betze/Post Mine
6B-Barrick-TS Ranch Reservoir
7-Barrick - Meikle Mine
8-Newmont-Post Mine/Mill#4 and Tailing Impoundment #1
9-Newmont-Blue Star/Genesis Mine, Section 36 Project, & Deep Star Underground Mine
10-Newmont-North Area Leach Pad and Facilities
11-Newmont-Mill #4 Tailing Impoundment #2
12-Newmont - Bullion Monarch Mine
13-Newmont-Carlin Mine/Mill #1 and Underground Mine
14A-Newmont-South Operations Area Project (SOAP)
14B-Newmont-Maggie Creek Ranch Reservoir
14C-Newmont-North Area Haul Road
15A-Newmont-Pair/SMZ Mine/Mill #3 and Underground Mine
15B-Newmont-Emigrant Mine
24-Newmont-Leeville
25-Newmont-Lantern Mine
26-Newmont-Pete Deposit
28-Barrick-Rodeo/Goldbug Underground Mine

AREAS OF CURRENT MAJOR EXPLORATION ADJACENT TO AREA OF MAJOR MINING DISTURBANCE

16-Barrick - Meridian JV Rossi Project
18-Newmont-High Desert Project
19-Newmont-Mike Project
20-Newmont-Chevas Project
22-Newmont-Emigrant Project
30-Newmont-Woodruff Creek
31-Cameco (USI-Ren Project
33-Great Basin Gold Inc.-Ivanhoe Project
34-Barrick-Goldstrike Project
37-Barrick-Dee Project

LOCATIONS OF REASONABLY FORESEEABLE MINE DEVELOPMENTS

17-North Area Bioleach Facility
23-Meridian Gold-Rossi (Storm) Deposit
35-Great Basin Gold Inc.-Ivanhoe Underground Mine
36-Newmont-Chukar Footwall Underground Project

LOCATIONS OF KNOWN UNDEVELOPED GOLD DEPOSITS

29-Newmont-Mike

Cumulative Effects Area and
Mining Activity In The Carlin Trend
Leeville Project
FIGURE 4-1

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TABLE 4-1
Existing and Reasonably Foreseeable Mining Disturbance in the Carlin Trend

Map Ref. No.	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	2000-2020	Total	
1	Newmont/Great Basin Gold, Inc. - Hollister/Ivanhoe Mine	0	268	0	268	Mine currently undergoing closure and reclamation. POO-N16-87-002P/Ivanhoe underground is foreseeable action.
2	Baroid - Rossi Mine	100	183	280	563	Active barite mine, currently under exploration for gold. POO-N16-81-003P. Mine expansion is foreseeable action.
3	Glamis Gold Ltd. - Dee Gold Mine	0	802	18	820	POO-N16-83-005P. Mine currently undergoing closure & reclamation
4	Newmont – Bootstrap Project	234	0	1,056	1,290	Active gold mine. POO-N16-94-002P
5	Homestake Mining Co. – Ren Mine	0	62	0	62	Inactive mine and heap leach facility; closure and reclamation in progress. POO-N16-88-005P.
6A	Barrick – Betze/Post Mine	0	6,758	2,615	9,373	Active gold mine with dewatering. POO-N16-88-002P.
6B	Barrick - TS Ranch Reservoir	0	495	0	495	Reservoir for discharged mine water from Betze/Post Mine. POO-N16-88-002P.
7	Barrick – Meikle Mine	0	92	0	92	Underground gold mine with dewatering. POO-N16-92-002P
8	Newmont – Post/Mill #4 & Tailing Impoundment #1	0	884	0	884	Existing mill and tailing facility. POO-N16-88-008P
9	Newmont- Blue Star/Genesis Mine, Sec. 36 Project (North Star, Bobcat, Payraise, Sold and Beast Pits), & Deep Star underground mine	200	1,290	1,022	2,512	Active gold mines. POO-N16-88-007P
10	Newmont – North Area Leach Facility	0	494	169	663	Existing leach pad facility. POO-N16-88-007P.
11	Newmont-Mill#4 Tailing Impoundment #2	0	280	15	295	Existing tailing facility. POO-N16-88-008P
12	Newmont – Bullion Monarch Mine (formerly Universal Gas)	50	0	0	50	Inactive mine, mill and tailing facility; closure and reclamation in progress. Notice N16-81-013N
13	Newmont – Carlin Mine/Mill #1 and Underground Mine	0	1,598	0	1,598	Active gold mine. Expansion (Pete Project) permitting in progress. POO-N16-81-010P
14A	Newmont – South Operations Area Project (SOAP)	0	7,960	1,320	9,280	Active gold mine. Expansion permitting in progress. POO-N16-81-009P
14B	Newmont – Maggie Creek Ranch Reservoir	0	300	0	300	Reservoir for discharged mine water from Gold Quarry Mine. POO-N16-81-009P.
14C	North Area Haul Road	0	189	0	189	North-South haul road. POO-N16-81-009P.
15A	Newmont - Rain and SMZ Mine/Mill #3 and Underground Mine	0	954	7	961	Active gold mine. POO-N16-86-007P. Expansion permitting in progress (Emigrant Project).
15B	Newmont - Emigrant Mine	0	0	418	418	Proposed open-pit gold mine; permitting in progress. Expansion of Rain Mine Project. POO-N16-86-007P.
17	North Area Bioleach Facility	0	0	600[2]	600	Foreseeable gold leach operation (Newmont).
23	Meridian Gold-Rossi (Storm) Deposit	0	0	100[2]	100[2]	Foreseeable underground mine.
24	Newmont – Leeville	0	0	486	486	Proposed underground mine and facilities. POO-N16-97-004P
25	Newmont – Lantern Mine	0	235	394[2]	629	Open pit gold mine and foreseeable expansion. POO-N16-88-007P
26	Newmont - Pete Project	0	0	863	863	Proposed open pit gold mine and leach operation. Expansion of Carlin Mine. POO-N16-81-010P
28	Barrick-Rodeo/Goldbug Underground Exploration Shaft	0	0	50	50	Underground mine.
35	Great Basin Gold-Underground Mine	0	0	100[2]	100[2]	Foreseeable underground mine.
36	Newmont-Chukar Footwall Underground Project	0	0	0	0	Foreseeable underground mine.
Total Disturbance Acres		**584**	**22,844**	**9,513**	**32,941**	

1. Projects permitted by BLM as of 2/4/00
2. Acreages for reasonably foreseeable disturbances (1998-2020) are estimates subject to change upon submittal of the actual proposal.

Note: Exploration projects shown in **Figure 4-1** total 1,124 acres; Newmont Chevas (POO-N16-93-002P) = 168 acres; Newmont Mike (POO-N16-92-004P) = 48 acres; Newmont High Desert (POO-N16-92-003P) = 164 acres; Newmont Emigrant (POO-N16-93-001P) = 63 acres; Barrick Meridan JV Rossi (POO-N16-90-002P) = 51 acres; Newmont Woodruf Creek (POO-N16-96-002P) = 66 acres; Cameco (US) REN (POO-N16-97-003P) = 30 acres; Newmont Carlin (POO-N16-81-002P) = 255 acres; Great Basin Gold Ivanhoe (POO-N16-93-003P) = 15 acres; Barrick Dee (POO-N16-98-001P) = 21 acres; Barrick Goldstrike (POO-N16-98-002P) = 233 acres; Barrick Storm Decline (POO-N16-99-001P) = 10 acres.

TABLE 4-2
Existing and Reasonably Foreseeable Mining Disturbance in the Carlin Trend from Open-Pits Only

Map Reference Number	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance for Open-Pits Only (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	1999-2020	Total	
1	Newmont/Great Basin Gold, Inc. - Hollister Mine	0	54	0	54	Open pit gold mine currently undergoing closure and reclamation. POO-N16-87-002P.
2	Baroid - Rossi Mine	0	80	100[2]	180	Active barite mine, currently under exploration for gold. POO-N16-81-003P. Expansion of open pit is a foreseeable future action.
3	Glamis Gold Ltd. – Dee Gold Mine	0	136	248	384	Active gold mine. POO-N16-83-005P.
4	Newmont – Bootstrap Project	59	0	155	214	Active gold mine. POO-N16-94-002P. Capstone Pit has been backfilled (approximately 10 acres).
5	Homestake – Ren Mine	0	5	0	5	Inactive mine and heap leach facility; closure and reclamation in progress. POO-N16-88-005P
6A	Barrick – Betze/Post Mine	0	1,412	0	1,412	Active gold mine with dewatering. POO-N16-88-002P
9	Newmont - Blue Star/Genesis Mine and Section 36 Project (North Star, Bobcat, Payraise, Sold and Beast Pits)	50	506	420	976	Active open-pit and underground gold mines. POO-N16-88-007P
12	Newmont – Bullion Monarch Mine (formerly Universal Gas)	6	0	0	6	Inactive open pit mine, mill and tailing facility; closure and reclamation in progress. Notice N16-81-013N
13	Newmont – Carlin Mine	100	226	0	326	Active gold mine. POO-N16-81-010P
14A	Newmont- South Operations Area Project (SOAP)	0	815	1,158	1,973	Active gold mine with dewatering. POO-N16-81-009P
15A	Newmont - Rain and SMZ Mine	0	165	7	172	Active gold mine. POO-N16-86-007P
15B	Newmont - Emigrant Project	0	0	123	123	Proposed open pit gold mine. Permitting in progress; POO-N16-87-006P
25	Newmont – Lantern	0	53	47[2]	100	Active open pit gold mine and foreseeable mine expansion. POO-N16-88-007P
26	Newmont - Pete Mine	0	0	487	487	Proposed open pit gold mine; Permitting in progress. POO-N16-81-010P
Total Disturbance Acres From Open Pits Only		215	3,452	2,745	6,412	

[1] Projects permitted by BLM as of 2/4/00.
[2] Acreages for reasonably foreseeable disturbances (1998-2020) are estimates subject to change upon submittal of the actual proposal.

Dewatering activities associated with Newmont's South Operations Area Project would continue into the near future. The combined cones of depression created by Newmont's South Operations Area (i.e., Gold Quarry Mine) and Barrick's Goldstrike Property dewatering programs would continue to create additive effects in regional groundwater drawdown.

Reclamation Activities

Reclamation of mined land throughout the Carlin Trend would restore portions of the land surface and would reduce impacts created by mining, including wildlife, grazing, and visual impacts. Vegetation that resembles natural, undisturbed areas would become established and allow disturbance areas to blend with adjacent areas. Highwalls associated with open pits and cuts would continue to disrupt the natural visual elements.

GEOLOGY AND MINERALS

Summary

The Proposed Action and Alternatives would have direct impacts on geologic and mineral resources. The impacts would be limited to excavation and relocation of waste rock, processing of ore, and removal of gold. The No Action Alternative would result in the loss of an unrealized gold reserve.

Indirect impacts would involve potential discharge of acidic water from waste rock disposal facilities and sulfide-bearing ore stockpiles. Static geochemical acid-base accounting (ABA) test results indicate that a small percentage of ore and waste rock that would be generated under the Proposed Action is potentially acid-generating (PAG). Meteoric Water Mobility Procedure (MWMP) tests indicate that waste rock and refractory ore have potential for leaching some metals. However, Newmont has developed a program for hydrologic PAG isolation and encapsulation. This approach would minimize acid generation and leachate migration in stockpiles to prevent adverse environmental effects resulting from stockpiling mine rock. Newmont has also proposed reclamation methods for waste rock facilities to prevent post-mining acid generation within the stockpiles.

The proposed Plan of Operations states mine stopes would be backfilled with neutral or acid-neutralizing aggregate cement. This procedure should prevent future acid generation from exposed PAG rock within the underground workings.

Proposed acid generation and leachate migration control measures include construction of refractory ore stockpiles and waste rock dumps on low permeability bases, encapsulation of PAG waste rock, and inspection and monitoring programs. These measures are expected to adequately mitigate potential impacts of stockpiling ore and disposing waste rock under the Proposed Action and Alternatives. These measures are described in greater detail in the Waste Rock Disposal Facilities section of Chapter 2. Potential instability of disposal and storage facilities would be mitigated through proper design and construction.

Direct and Indirect Impacts

Proposed Action

Geologic and mineral resources within the area affected by the proposed Leeville Project would be directly impacted by relocation of approximately 4 million tons of waste rock and 14 million tons of ore. The Proposed Action would create indirect impacts by placing potentially acid- generating (PAG) rock in waste rock disposal areas and by exposing sulfide material in the refractory ore stockpile to oxygen. Rain and snowmelt infiltrating through waste rock and ore piles could potentially cause an acidic water discharge containing elevated concentrations of some metals.

Under the Proposed Action, a refractory ore stockpile and waste rock facility would be constructed in Section 10, T35N, R50E (**Figure 2-4**). Ore would be transported directly to processing facilities or refractory ore stockpiles. All waste rock would be transported to the waste rock facility. The proposed Plan of Operations states most of the mined out stopes would be backfilled with cemented rock fill.

Tonnage of waste rock to be extracted under the Proposed Action has been estimated for the life of the project according to rock type (Coxon 1997). Total waste rock tonnage and tonnage-weighted acid-base accounting (ABA) values are listed in **Table 4-3**. PAG rock has a neutralization potential ratio (NPR) of less than the BLM Standard 3:1 and the NDEP Standard 1.2:1 (BLM 1996b). These data indicate that approximately 75 percent of the estimated 4 million tons of waste rock would be West Leeville lower plate unoxidized carbonate, which is non-PAG rock. The remaining 25 percent consists of a mix of West Leeville, Four Corners, and Turf deposits, the majority of which is also non-PAG. The Four Corners waste rock is PAG, and constitutes approximately 5 percent of the total tonnage. The West Leeville upper plate carbon sulfide refractory waste rock is potentially PAG and constitutes approximately 2.5 percent of the total tonnage.

TABLE 4-3
Waste Rock Tonnage Estimates and Tonnage-Weighted ABA Values
(ABA Data from Laboratory Analyses)
Leeville Mine Project

Waste Rock				Waste Tonnage		ABA Values			
Deposit	Domain	Formation	Lithology	Tonnage	Fraction of Tonnage	NNP	NPR	Tonnage Weighted NNP	Tonnage Weighted NPR
West Leeville(WLW1)	UP	Ovi	UC	21,920	0.006	106	4.1	0.6	0.0
West Leeville(WLW2)	UP	Ovi	CSR	102,476	0.026	10.2	1.3	0.3	0.0
West Leeville(WLW3)	LP	Unk	UC	2,912,483	0.737	152	15.7	112.1	11.6
Four Corners(FCW1)	LP	Unk	CSR	210,295	0.053	-27.1	0.4	-1.4	0.0
Turf(TW1)	UP	Drc	CSR	15,207	0.004	9.5	1.4	0.04	0.006
Turf(TW2)	LP	Dp	UC	124,122	0.031	104	3.2	3.3	0.1
Turf(TW3)	LP	SDrm HW	UC	40,552	0.010	171	6.5	1.8	0.1
Turf(TW5)	LP	SDrm FW	Unk	370,585	0.094	137	6.3	12.9	0.6
Turf(TW6)	LP	SDrm	UC	152,755	0.039	315	26.2	12.2	1.0
Total				**3,950,395**	**1.000**			**141.6**	**13.3**

Note: NA = Data not available; ABA = acid-base accounting; NNP = net neutralization potential; NPR = neutralization potential ratio; WLW = West Leeville Waste; FCW = Four Corners Waste; TW = Turf Waste; UP = Upper Plate; LP = Lower Plate; Unk = Unknown; Ovi = Vinini Formation; Drc = Rodeo Creek Formation (Turf Deposit); Dp = Popovich Formation; SDrm = Roberts Mountains Formation; HW = Hanging Wall; FW = Footwall; UC = unoxidized carbonate; CSR = carbon sulfide refractory.
The equation used to calculate weighted average is: y = (0.006 x WLW1) + (0.026 X WLW2) + (0.737 x WLW3) + (0.053 x FCW1) + (0.004 x TW1) + 0.031 x TW2) + (0.010 x TW3) + (0.094 x TW5) + 0.039 x TW6).
Source: Coxon 1997

A small amount of upper plate Turf waste rock is PAG and would only be mined to develop a ventilation shaft proposed as a contingency.

Data in **Table 4-3** collectively indicate the total mass of waste rock would be non-PAG with a net neutralization potential (NNP) of 141 and a NPR value of 13. Waste rock volume is estimated at 3.9 million tons (Newmont 1997a). Operational sampling during development and exploration would be used to monitor waste rock geochemistry.

Table 4-4 summarizes average metal mobility values, calculated for the MWMP results using the tonnage presented in **Table 4-3**. These results indicate that seepage from waste rock would exceed water quality standards for antimony (Sb), arsenic (As), manganese (Mn), nickel (Ni), selenium (Se), sulfate and total dissolved solids (TDS).

Newmont has developed guidelines for storage and disposal of PAG waste rock and ore and rock material that have potential to release metals (Newmont 1997a). The objective of the guidelines is to minimize potential for acid drainage by controlling the acid generation process. Control measures for waste rock and stockpiled ore include: 1) placing PAG rock on a base constructed of compacted low permeability materials designed to minimize leaching to groundwater; 2) segregating and/or mixing PAG rock; 3) encapsulating PAG rock within acid-neutralizing rock (NNP greater than + 40); 4) sloping and wheel compacting lift surfaces; 5) controlling surface water to minimize infiltration; 6) encapsulating and capping PAG rock during reclamation; and 7) reclaiming the waste rock disposal facility. The ore stockpile is temporary and, therefore, would not be capped and reclaimed.

ABA data indicate the total mass of waste rock to be generated over the Project life would be non-PAG. However, of this total mass, concentrated volumes of PAG rock would be produced at specific points in the mining sequence. An estimated 210,295 tons of Four Corners waste rock that is PAG would be generated between 2003 and 2010, and another 102,476 tons of West Leeville waste rock that is PAG would be generated in 2002 and 2003. MWMP analyses indicate the three deposit types have potential to leach certain metals. PAG waste would be encapsulated with rock with a high net neutralization potential (NNP) in order to neutralize acid generated by the waste rock. The waste rock facilities would be constructed on a low permeability base to inhibit leaching of metals into groundwater. At closure, the waste rock facilities would be capped by a 24 inch base of topsoil or other suitable growth medium and revegetated to minimize potential infiltration.

TABLE 4-4
Average Metal Mobility Values for Waste Rock
Leeville Mine Project

	Nevada Water Standards (mg/L)	MWMP Results From Weighted Average ROM Waste Rock (mg/L)
Metals		
Antimony (Sb)	0.146	1.195
Arsenic (As)	0.05	0.15
Barium (Ba)	2.0	0.02
Beryllium (Be)	0.004*	0.001
Cadmium (Cd)	0.005	0.003
Chromium (Cr)	0.1	0.006
Copper (Cu)	1.3*	0.004
Iron (Fe)	0.3* (s)	0.04
Lead (Pb)	0.05	0.0025
Manganese (Mn)	0.05* (s)	0.17
Mercury (Hg)	0.002	0.0002
Nickel (Ni)	0.0134	0.3626
Selenium (Se)	0.05	0.08
Silver (Ag)	——	0.008
Thallium (Tl)	0.013	0.009
Zinc (Zn)	5.0* (s)	0.27
Non-metals		
Chloride (Cl)	250	6.8
Fluoride (Fl)	4.0*	0.5
Nitrate (NO_3)	10	0.09
Cyanide (CN)	0.2	0.01
Sulfate (SO_4)	250	832
Total Dissolved Solids (TDS)	500	1417
pH	5.0-9.0	--

Notes:
Nevada water quality standards are the "Municipal or Domestic Supply" values listed on **Table 3-13**; if no corresponding state standard exists, the federal drinking water standard is used and denoted by an asterisk (*). Values with (s) are secondary drinking water standard.
MWMP = meteoric water mobility procedure; ROM = run-of-mine; mg/L = milligrams per liter

Source: Coxon 1997

According to the proposed Plan of Operations, most mined out stopes would be backfilled with cemented rock fill (Newmont 1997a). Access levels, excavations for underground facilities, and shafts would not be backfilled. The backfill would consist of neutral or acid-neutralizing material from existing open pit operations in the area or Project waste rock.

Methods of post-mining waste rock facility reclamation have been proposed by Newmont (1997a). These methods include regrading and revegetating the waste rock facility and diverting run-on surface water. These actions would stabilize the stockpiles and simultaneously limit infiltration and erosion. Quarterly inspection of refractory ore stockpiles and waste rock disposal facilities would be conducted for signs of acid rock drainage (ARD) production and to ensure integrity of the cover and surface water management systems.

Any disruption to mine facilities and workings from seismic activity would be from liquefaction or ground rupture. Liquefaction occurs when seismic shaking causes earth material to lose its inherent strength and behave like a liquid. In general, liquefaction can occur where earth material is fully saturated, loose, unconsolidated, and/or sandy. Surface or underground rupture may occur along an active fault trace during an earthquake. Underground workings are typically designed to withstand pressures exerted by the overlying mass of rock. These design criteria are typically much

greater than ground shaking or acceleration stresses exerted by earthquakes.

Alternative A and/or C

Impacts on geology and mineral resources from implementation of Alternative A and/or C would be similar to those described under the Proposed Action.

Alternative B

Implementation of Alternative B (backfill shafts) would preclude the likelihood of further mining the potential geologic resource.

No Action Alternative

The No Action Alternative would avoid potential direct and indirect impacts of the Proposed Action. It would also eliminate the recovery of approximately 14,081,000 tons of ore from the geologic resource at the Leeville Project site.

Cumulative Impacts

The cumulative impacts area for geology and mineral resources depicted in **Figure 4-1** incorporates existing and reasonably foreseeable mining activity through 2020. The area included in this analysis includes the Carlin Trend and extends from the Emigrant Project in the southeast to the Hollister Mine in the northwest. Cumulative impacts of dewatering operations for the Goldstrike Property, South Operations Area Project, and Leeville Project were evaluated in the Cumulative Impact Analysis report (BLM 2000a).

The primary issue identified by BLM (2000a) for assessment of cumulative impacts to geology and minerals is the potential for development of sinkholes or other karst-type collapse features that could result from mine induced groundwater drawdown or other water management activities.

The BLM (2000a) stated that sinkholes develop in areas where: 1) mine dewatering is predicted to lower the water table or increase infiltration; or, 2) areas with soluble carbonate rocks at or near the ground surface. In order for sinkholes to be propagated to the surface, limestone would need to occur at depths less than 50 to 100 feet, and water levels would need to be greater than about 300 feet. Limestone in the Leeville Project area occurs at about 800 feet below ground surface and the depth to water is about 1,000 feet (**Figure 3-11**). Therefore, the proposed Leeville Project mine site is in an area unlikely to be impacted by sinkhole development (BLM 2000a).

Areas that are susceptible to karst development are located within the groundwater drawdown cone of depression created by mine dewatering systems in the Carlin Trend (**Figure 4-4**). The potential that a sinkhole would develop at any given location in the Carlin Trend depends on specific site conditions including depth to carbonate rocks, mineralogy of the carbonate rock, hydrostratigraphy of the rock, size of voids in the rock, characteristics of overlying materials, and the site specific effects of cumulative mine dewatering on groundwater at the site (BLM 2000a).

Because gold mining is a major activity in the Carlin Trend, it is reasonable to assume that large-scale mining would continue and result in creation of open pits, underground mines, waste rock disposal areas, heap leach pads, milling and tailing storage facilities, and administrative offices. Future exploration may also result in delineation of deeper oxide and refractory ore zones that would require dewatering systems for economical recovery of ore. It is not possible to quantify the total volume of ore, waste materials, and gold that could be economically excavated from the Carlin Trend in the future.

Topography of the area would continue to be modified as a result of mine excavation, waste rock and tailing disposal, and reclamation. Continued mining may afford the opportunity to backfill mined-out pits with waste rock from future operations. Such opportunities would be judged individually and based upon accessibility as well as influence on future mining activities. Backfilling and subsequent reclamation would restore land to pre-mining uses.

Potential Mitigation and Monitoring Measures

At closure, Newmont would develop a plan to provide long-term monitoring for acid generation associated with the Waste Rock Disposal Facility. Newmont would be required to monitor

for waste rock seepage for a period of 30 years after reclamation is completed at the Leeville Project site. This time period for monitoring would be reviewed periodically by the agencies to determine whether modifications to the monitoring program are warranted.

If sinkholes form in karst-prone areas and their formation is attributable to the Leeville Project, Newmont would be required to backfill the sinkhole(s) and restore the land surface. No other mitigation or monitoring measures beyond those described in the Plan of Operations have been identified.

Newmont would modify their encapsulation procedure to incorporate limestone as the material to form the base, sides, and top of the PAG rock encapsulation disposal facility. Use of limestone would provide positive acid neutralizing potential to the acidic leachate that could form in the waste rock disposal facility.

Irreversible and Irretrievable Commitment of Resources

Approximately 14,081,000 tons of ore would be removed from the geologic resource at the Leeville Mine if the Proposed Action is implemented. This action would constitute an irreversible commitment of the geologic resource.

Residual Adverse Effects and Impacts of Mitigation

No residual adverse effects to the geologic resource would be expected from the Proposed Action and mitigation measures.

PALEONTOLOGICAL RESOURCES

Summary

Physical disturbance associated with the Leeville Project could result in limited impacts to paleontological resources. If vertebrate fossils are discovered during mine development or operational activities, Newmont would cease mining in the vicinity of the fossil discovery, and contact BLM to determine steps necessary to evaluate the discovery. Potential impacts for Alternative A and/or B would be similar to the Proposed Action. Impacts would be limited to areas of land disturbance. Potential impacts that would result from Alternative C would be less because fewer acres of land would be disturbed.

Direct and Indirect Impacts

Proposed Action

Paleontological resources in the Leeville Project study area could consist of vertebrate, invertebrate, and paleobotanical fossils. Vertebrate fossils are more likely found in Tertiary- and Quaternary-age sediments, where-as invertebrate fossils are more common in Paleozoic-age strata. Known fossils in the study area have a relatively broad regional distribution, and are not restricted to the study area or north-central Nevada. No known fossil quarries or vertebrate fossils are located in the area to be physically disturbed by the proposed Leeville Mine. Impacts on any fossils that may exist in the proposed disturbed area would usually be direct, caused by physical disturbance.

Alternatives A and B

Impacts on paleontological resources under Alternatives A and/or B would be similar to those described under the Proposed Action.

Alternative C

Impacts on paleontological resources resulting from implementation of Alternative C would be reduced commensurate with 118 acres less new surface disturbance.

No Action Alternative

The No Action Alternative would avoid potential direct and indirect impacts of the Proposed Action and other action alternative to paleontological resources.

Cumulative Impacts

The cumulative impact area for paleontological resources includes areas potentially disturbed by mining activities through 2020. Vertebrate fossils occur primarily in Tertiary- and Quaternary-age sediments and invertebrate fossils are more common in Paleozoic-age sedimentary rocks. Because of the greater abundance of vertebrate fossils, mining activity that intercepts Tertiary-age sediments would have the greatest potential for impacting paleontological resources. Other mining-related excavations (e.g., leach pads, waste rock disposal areas) are shallow and would primarily affect unconsolidated soil surfaces. While the cumulative impact of mining in the Carlin Trend may result in loss or destruction of fossils, this region of Nevada is not known for significant paleontological resources.

Potential Mitigation and Monitoring Measures

If vertebrate fossils are discovered during project construction or operation the following mitigation measures would be implemented:

- Newmont would suspend operations in the immediate vicinity of the discovery;
- BLM would be notified within 24 hours of the discovery;
- Newmont would take necessary measures to protect the resource until an evaluation has been completed by BLM; and
- BLM would define an appropriate level of treatment if the discovery is determined significant.

Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of paleontological resources could occur as a result of the Proposed Action if fossils are encountered in the disturbance areas.

Residual Adverse Effects and Impacts of Mitigation

Minimal residual adverse effects on paleontological resources are possible, but not likely, as a result of the Proposed Action or mitigation measures. Some paleontological resources could be damaged or partially destroyed during mine development if they are not discovered prior to disturbance. Implementation of mitigation measures would however, result in protection or documentation of paleontological resources that would otherwise be lost. It is believed by some specialists in the field of paleontology that even if discovered, removal and recovery of fossils only provides a partial mitigation of the potential resource lost.

AIR QUALITY

Summary

Mining-related activities at the Leeville Project would be a source of particulate and gaseous air pollutants. Fugitive dust emissions would be generated by mining, processing, hauling, storing ore, and disposal of waste rock. Particulate emissions would be mitigated by dust suppression and Best Management Practices (BMPs) as outlined in the Handbook of Best Management Practices (Nevada State Conservation Commission 1994). Gaseous pollutant emissions would result from blasting, construction and mining equipment, and vehicle exhaust. These emissions would be minimized by proper equipment maintenance and operation. Newmont would seek any required air quality construction and operating permits from the Nevada Division of Environmental Protection (NDEP), Bureau of Air Quality.

Implementation of Alternative A and/or C would result in the same amount and type of air contaminant emissions as the Proposed Action. Alternative B would require approximately 1500 truck-loads of waste rock to be hauled to the production and ventilation shafts resulting in additional gaseous emissions from vehicles and fugitive dust from loading and hauling. Leeville Project emissions would not affect air quality or visibility in any Class I areas.

Direct and Indirect Impacts

Proposed Action

Gaseous and particulate air contaminant emissions would be generated during construction and continue throughout the mining period. Construction of surface facilities, including the pipeline route, would generate fugitive dust from excavation, earth moving, and vehicle traffic. Underground mining, crushing, and ore-handling activities would create fugitive dust.

Diesel engine exhaust from construction equipment, underground mining equipment, and various transportation vehicles would generate gaseous air pollutants. Emissions from underground operations would be ventilated through four ventilation shafts.

Particulate Emissions

Mining would occur underground with fugitive dust emissions controlled at the point of generation. Rock would be extracted using conventional drill and blast techniques. Some rock might be excavated using a mechanical miner. Drilling would be completed using jackleg drills, jumbos, or bench drills. All drilling activities would be performed "wet" to minimize airborne dust. After blasting, muck piles would be wetted to reduce dust. Water sprays would be installed at the grizzly to minimize dust from rock handling.

From the grizzly, ore would be conveyed to ore bins. Skips would be used to hoist ore and waste rock to the surface where it would be dumped into a head frame bin. The rock would be transferred from the bin via conveyors to surface stockpiles. Fugitive particulate emissions from material handling and storage above ground would be concentrated around storage piles.

Leeville Project plans include backfill plants that would consist of backfill stockpiles, conveyors, and cement silos. Fugitive dust emissions would be generated from wind erosion of disturbed areas and road dust. All haul roads would be maintained on a continuous basis for safe and efficient haulage and to minimize fugitive dust emissions. Generation of fugitive dust from ore handling, crushing, and grinding activities would be controlled using Best Management Practices (Nevada State Conservation Commission 1994) which could include direct water application, use of approved chemical binders or wetting agents, water spray, baghouses, and revegetation of disturbed areas concurrent with operations.

Gaseous Emissions

The Leeville operations would be a source of gaseous air pollutants including sulfur dioxide (SO_2), carbon monoxide (CO), oxides of nitrogen (NOx), and volatile organic compounds (VOCs). The primary source of these emissions would be exhaust from diesel engines used to power construction equipment, mining machines, and haul trucks. Gaseous emissions from diesel engines would be minimized through proper operation and maintenance.

Another source of gaseous pollutants in the Leeville mining operations would be from ammonium nitrate and fuel oil (ANFO) used as blasting agents. The use of ANFO can cause fugitive emissions of NOx, CO, and SO_2. Emissions from ANFO would be reduced by restricting use to underground operations where emission would be controlled.

Electrical power would be provided by an existing transmission line. A large diesel electrical generator would be installed for emergency evacuation and ventilation in the event of a power failure.

Mercury Emissions

Ore from the Leeville Project would be processed at Newmont's South Operations Area processing facility. Carbon handling and refinery services at the South Operations Area facility create mercury emissions. Diesel and gas combustion sources also emit mercury.

As described in the Proposed Action in Chapter 2, Newmont would transport all ore generated from Leeville operations to the South Operations Area for processing. Newmont has developed a detailed air toxics inventory for the South Operations Area facility using stack test results, emissions factors, actual processing rates, and hours of operation to determine actual mercury emissions for 1998 and 1999. Based on Newmont's Toxic Release Inventory (TRI), total air borne emissions of mercury from the South Operations Area processing facility were 82 pounds in 1998 and 90 pounds in 1999.

Maximum potential hourly emissions would not increase due to processing of the Leeville ore at the South Operations Area. Leeville ore would offset production from existing sources with no projected increases in total annual mercury emissions from the South Operations Area.

Mercury is included on the federal list of hazardous air pollutants, which has been adopted by reference in the Nevada air quality regulations. Nevada air quality regulations (NAC445B.349) prohibit the "*discharge into the atmosphere from any stationary source of any hazardous air pollutant or toxic regulated air pollutant that threatens the health and safety of the general public, as determined by the director*."

The EPA has not established a National Emission Standard for Hazardous Air Pollutants (NESHAPs) for mercury emissions from gold ore processing facilities. Mercury is not considered a primary pollutant and no national or Nevada ambient air quality standard (NAAQS) have been established under the Clean Air Act.

In November 2000, the Nevada Division of Environmental Protection (NDEP) published a report entitled "*Mercury Emissions from Major Mining Operations in Nevada*." The NDEP report concludes that, based upon review of available information, "there is currently no imminent and substantial public health threat associated with mercury emissions in the region. NDEP will continue its current mercury monitoring efforts and will track monitoring efforts of other agencies." The report also states that there is "insufficient data to determine whether the mercury measured in the environment of the region results from natural or anthropogenic sources."

Alternatives A and C

Implementation of Alternative A and/or C would result in similar impacts to air quality as those described for the Proposed Action.

Alternative B

Alternative B would require approximately 1500 truck loads of waste rock to be hauled to the production and ventilation shafts resulting in additional gaseous emission from vehicles and fugitive dust from loading and hauling.

No Action Alternative

The No Action Alternative would eliminate potential impacts of the Proposed Action on air quality.

Cumulative Impacts

Fugitive dust and gaseous emissions from nearby mine operations affect air quality in the Project area. The Leeville Project would create continued and extended haul truck traffic on the North Area Haul Road as well as extended operation of milling facilities at the South Operations Area. Ambient air quality data for the region currently reflects impacts of existing mining operations in the airshed. Air quality in the region meets applicable standards and would be expected to remain in compliance with addition of Leeville operations. Approximately 2,000 lbs. of mercury and mercury compounds was reported released annually to air by mining operations in the Carlin Trend (NDEP 2000).

Potential Mitigation and Monitoring Measures

Air quality emission sources at the Leeville Project would be subject to requirements of federal and Nevada air quality regulations. NDEP Bureau of Air Quality would determine whether air quality construction and operating permits would be required for the Project. The air quality permitting process could require that Newmont submit a permit application, including a complete inventory of potential criteria air pollutant emissions from the Project.

Industrial air quality permitting is part of the Nevada State Implementation Plan (SIP) process. The NDEP Bureau of Air Quality uses air quality permit conditions to help ensure compliance with applicable Nevada regulations and National Ambient Air Quality Standards (NAAQS), and Prevention of Significant Deterioration (PSD) increments. The area surrounding the Leeville site is a designated Class II area as defined by the federal PSD program (see Chapter 3, *Air Quality*).

The nearest PSD Class 1 area is Jarbidge Wilderness, located approximately 75 miles northeast of the Leeville site. Fugitive particulate and gaseous emissions from the Leeville Project
would not be expected to create an impact at the Jarbidge Wilderness due to the distance between the sites. The Leeville Project would not be visible from Jarbidge Wilderness and emissions from the operations would not be expected to contribute to degradation of visibility in the Class I area.

Crushing and conveying operations would be subject to emission and reporting requirements of the New Source Performance Standards for Metallic Mineral Processing Plants (NSPS subpart LL). If the backfill plants do not crush or grind aggregate or limestone, they would not be subject to NSPS Subpart OOO, Standards of Performance for Nonmetallic Mineral Processing Plants. The NDEP Bureau of Air Quality would make final NSPS applicability determinations in the air quality permitting process.

Measures to reduce particulate emissions include reducing vehicle speed, minimizing drop heights during loading, watering, chemically stabilizing haul roads, and use of water spray, water fog, or baghouse fabric filter during crushing and ore handling.

Following submittal of an air quality permit application, NDEP could require an ambient air quality monitoring program to ensure compliance with ambient air quality standards.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of air resources would result from the Proposed Action or Alternatives.

Residual Adverse Effects and Impacts of Mitigation

No residual adverse effects on air resources would be anticipated as a result of the Proposed Action and mitigation measures. After cessation of mining and completion of reclamation activities, air quality would be expected to approach pre-mining conditions.

WATER QUANTITY AND QUALITY

Summary

Removal of groundwater using dewatering wells would be the primary cause of water-related impacts from the Leeville Mine. Leeville dewatering would add to regional groundwater drawdown currently created by dewatering at the Goldstrike Property and Gold Quarry Mine. Maximum dewatering rate for the Leeville Mine would be approximately 25,000 gallons per minute (gpm) during the first 2 years, followed by a gradual decline to about 8,000 to 10,000 gpm once the ultimate target depth is reached. Water would be routed through a water treatment plant constructed at the Leeville site to meet specified water quality standards. This water would then be pumped by pipeline and canal to Barrick's existing water management system in the Boulder Valley, where water is distributed to the TS Ranch Reservoir, other infiltration basins, and/or irrigation systems.

Water pumped from dewatering wells for the mine would increase the depth of groundwater lowering in a portion of the existing cone of depression in the Leeville Project area. This additional drawdown zone would be located within the areal extent of current and future groundwater drawdown resulting from other mines' dewatering systems in the Carlin Trend. A total of about 360,000 acre-feet of water would be removed by Leeville dewatering wells during the life-of-mine.

Discharge of excess water from the Leeville Mine dewatering system would be transported to infiltration basins (including TS Ranch Reservoir) and irrigation systems (seasonally). If these systems cannot handle all of Leeville's excess water during the first few years when dewatering rates are highest, Newmont would try to find other options of disposing water in the Boulder Valley before seeking approval from the State Engineer to discharge some water to the Humboldt River in Barrick's existing conveyance system. Approximately 212,000 acre-feet of water would be infiltrated into the Boulder Valley using the water management system over the life of the Leeville Project. Adverse impacts to surface water quality are not expected from mine dewatering at Leeville, other than minor additional chemical loading, because water would be treated prior to discharge to Boulder Valley. Minor increases in sedimentation would occur during construction activities.

Adverse impacts to groundwater quality from the Proposed Action are expected to be limited to minor short-term increases in some constituents (e.g., nitrate and some metals) immediately surrounding underground workings as the water table rises during recovery of the cone of depression. Most underground workings would be backfilled with cemented rock aggregate consisting of neutral or acid-neutralizing material.

Impacts to groundwater rights associated with the Leeville Project would include additional lowering of water levels for a limited number of wells. Adverse impacts to surface water rights are not expected to occur from the Proposed Action.

Dewatering at Leeville would extend the period of recovery to within 90 percent of the original water table by about 20 years after cessation of mining. This would affect recovery of water levels in impacted wells and recovery of reduced flow in impacted streams and springs/seeps. On a cumulative basis, reductions in baseflow resulting from the Leeville Project are predicted to be 0.1 cfs or less for each of the potentially affected streams (e.g., Maggie, Boulder, Beaver, and Marys creeks) and the Humboldt River.

Alternative A would eliminate water flowing in about one mile of open canal between the Leeville Mine and TS Ranch Reservoir. Complete backfill of the shafts (Alternative B) may cause minor short-term increases in some chemical constituents in groundwater within and surrounding the backfilled mine workings. Alternative C would result in a smaller disturbance area which would reduce the amount of sedimentation during construction activities on previously undisturbed land.

Direct and Indirect Impacts

Proposed Action

Primary impacts on water resources from the Leeville underground mine would be associated with the dewatering system. As described in the *Water Quantity and Quality* section of Chapter 3, the Leeville Mine site is located within the groundwater drawdown area created by dewatering wells associated with Barrick's nearby Betze/Post open pit mine and underground Miekle Mine (i.e., Goldstrike Property). Dewatering wells proposed for the Leeville Mine, therefore, would add to the ongoing regional lowering of the water table.

Water from the Leeville dewatering system that is not consumed for mine-related activities would be added to Barrick's water management system for the Goldstrike Property. Water in this system is discharged primarily to infiltration basins, including the TS Ranch Reservoir, which are located in the upper, northern part of the Boulder Valley (**Figure 3-5**). During the irrigation season, most excess mine water is used for flood and sprinkler irrigation in the Boulder Valley. Total irrigation acreage is in excess of 10,000 acres. Injection wells are also available near the infiltration basins, but typically are not used due to scaling problems in the wells. Also, water injected in the wells recharges the same aquifer as the infiltration basins, which are lower maintenance; therefore, there is little incentive to use the injection wells.

Barrick's conveyance system to the Humboldt River consists of 7 miles of buried pipeline, 13 miles of lined canal, and a discharge structure at the Humboldt River. Newmont does not propose to discharge excess mine water to the Humboldt River. If the existing system of infiltration and irrigation in the Boulder Valley cannot effectively handle the volume of excess water from Leeville operations, Newmont

would identify other locations within the Boulder Valley that may be suitable for infiltration and irrigation. If these locations cannot be established, Newmont would seek authorization from the State Engineer (per Ruling 5011) to use Barrick's conveyance system to an outfall at the Humboldt River.

Transportation and use of Hazardous Materials in the Project area could potentially impact surface and groundwater quality. Additional truck traffic servicing the Leeville Project may result in an increase of rollover accidents in Maggie Creek Canyon. Currently, nearly one truck accident per year results in fuel and/or cargo being spilled into or near Maggie Creek.

Impacts to surface and groundwater would vary depending on location and substance(s) released/spilled. Newmont has implemented an Emergency Response Plan (Newmont 1995b) and Spill Prevention, Control, and Countermeasure (SPCC) plan (Newmont 1995a) to address accidental spills or releases of Hazardous Materials. Accidental spills or releases due to malfunctioning components would be contained and remediated in accordance with these plans and applicable state and federal regulations.

Numerical Modeling

Hydrologic Consultants, Inc. (HCI), as a consultant to Newmont, used its numerical groundwater flow model of the Carlin Trend to predict groundwater inflow to the proposed Leeville underground mine and associated impacts that would occur to water resources from the Leeville dewatering system (HCI 1999a). Potential effects on water resources from all current and proposed dewatering operations along the northern Carlin Trend also are addressed by HCI (1999b) and in the Cumulative Impact Analysis report (BLM 2000a). A detailed summary of the Carlin Trend model is contained in the cumulative report (BLM 2000a). A summary of the numerical groundwater flow model for the Leeville Project is included as **Appendix B**.

In order to separate potential impacts to water resources associated with the proposed Leeville Mine from impacts associated with all other Carlin Trend area dewatering, HCI (1999b, 1999d) simulated regional dewatering with and without the Leeville Project. By comparing two modeled drawdown areas, it is possible to determine where groundwater drawdown has increased due to the projected Leeville dewatering system. The area of drawdown in the water table aquifer that would be caused by dewatering at the Leeville Mine only is shown on **Figure 4-2**. The cumulative change in lateral extent of predicted maximum drawdown areas in the water table aquifer is shown on **Figure 4-3**. These groundwater drawdown impacts are discussed later in this section (see *Impacts to Groundwater Levels and Storage* and *Cumulative Impacts*).

Impacts to Surface Water Quantity

The maximum groundwater pumping rate for Leeville is expected to be approximately 25,000 gpm for the first 2 years during the sinking of ventilation and production shafts. This rate would gradually decline to a range of about 8,000 to 10,000 gpm once the ultimate mining depth is reached (**Figure 3-7**). If water from the dewater-ing system is discharged directly to the Humboldt River (see **Figure 4-3** for discharge point) during non-irrigation season, flow in the river would increase downstream. Maximum flow to the river, if any, could be about 24,000 gpm (500 to 1,000 gpm would be consumed for mine operations), however, Newmont would continue disposal of excess water through infiltration and irrigation. Newmont estimates that discharge to the Humboldt River, if necessary, would not likely exceed 10,000 gpm (Pettit 2001). This additional flow is within the rate approved for Barrick's NPDES permit (69,000 gpm) associated with the Goldstrike Property. Barrick has not discharged water under this permit since February 1999, and has no plans to do so at present.

Changes in flow at several locations along the Humboldt River were evaluated for the dewatering period associated with the Leeville Project using discharge from the Goldstrike Property, Gold Quarry, and Leeville mines for low, average, and high water years (BLM 2000a). As Barrick does with its Goldstrike Property dewatering system, Newmont would retain all excess Leeville Mine water in the Boulder Valley using the TS Ranch Reservoir, irrigation, infiltration basins, and possibly injection wells.

Since the Humboldt River is over-appropriated, additional mine water in the river, if approved by the State Engineer, would be a benefit to water right holders in the basin. Most seasonal discharge to the river would occur during the

time when flow is generally low; therefore, no impacts to channel geometry are expected and aquatic habitat could be improved. Additional details on potential impacts to the Humboldt River can be found in the Cumulative Impact Analysis report (BLM 2000a) and Betze Project Draft Supplemental EIS (BLM 2000b).

The additional volume of groundwater removed by Leeville dewatering would extend the recovery time for streams that would have reduced flows after cessation of mining in the Carlin Trend. Streams within the direct impact area shown on **Figure 4-2** include Rodeo, Welches, and Sheep creeks (tributaries of Boulder Creek), middle Maggie Creek (in the Narrows), upper Simon, Lynn, James, Soap, and Cottonwood creeks (tributaries of Maggie Creek), and Marys Creek (tributary to Humboldt River). Most of these streams have perennial reaches interspersed with intermittent or ephemeral reaches. At higher elevations (i.e., above 6000 feet in elevation) the two primary sources of water are direct run-off from precipitation that falls in the mountains and a shallow perched groundwater system. At lower elevations the regional water table supplies the baseflow. Only that portion of baseflow supplied by the regional groundwater system could be affected by dewatering.

As described in the Betze Project Draft Supplemental EIS (BLM 2000b), unless impacts have already occurred to these streams from mine dewatering (i.e., possibly some seasonal affects on Rodeo Creek), the streams likely are not connected to the regional groundwater system and, therefore, would not be directly or indirectly affected by Leeville dewatering. Portions of streams in the drawdown area shown on **Figure 4-2** that have perennial flow below elevation 6000 feet probably are supplied by water sources above 6000 feet.

Using the Carlin Trend model (HCI 1999a), effects on stream flow from Leeville dewatering were predicted for Marys Creek, Maggie Creek, Boulder Creek, and Humboldt River. Effects on flow in these water bodies caused by Leeville are discussed in the *Cumulative Impacts* section for *Water Quantity and Quality*. Recovery to within 90 percent of the premining water table would take up to 20 more years due to Leeville dewatering, depending on the location within the cone of depression.

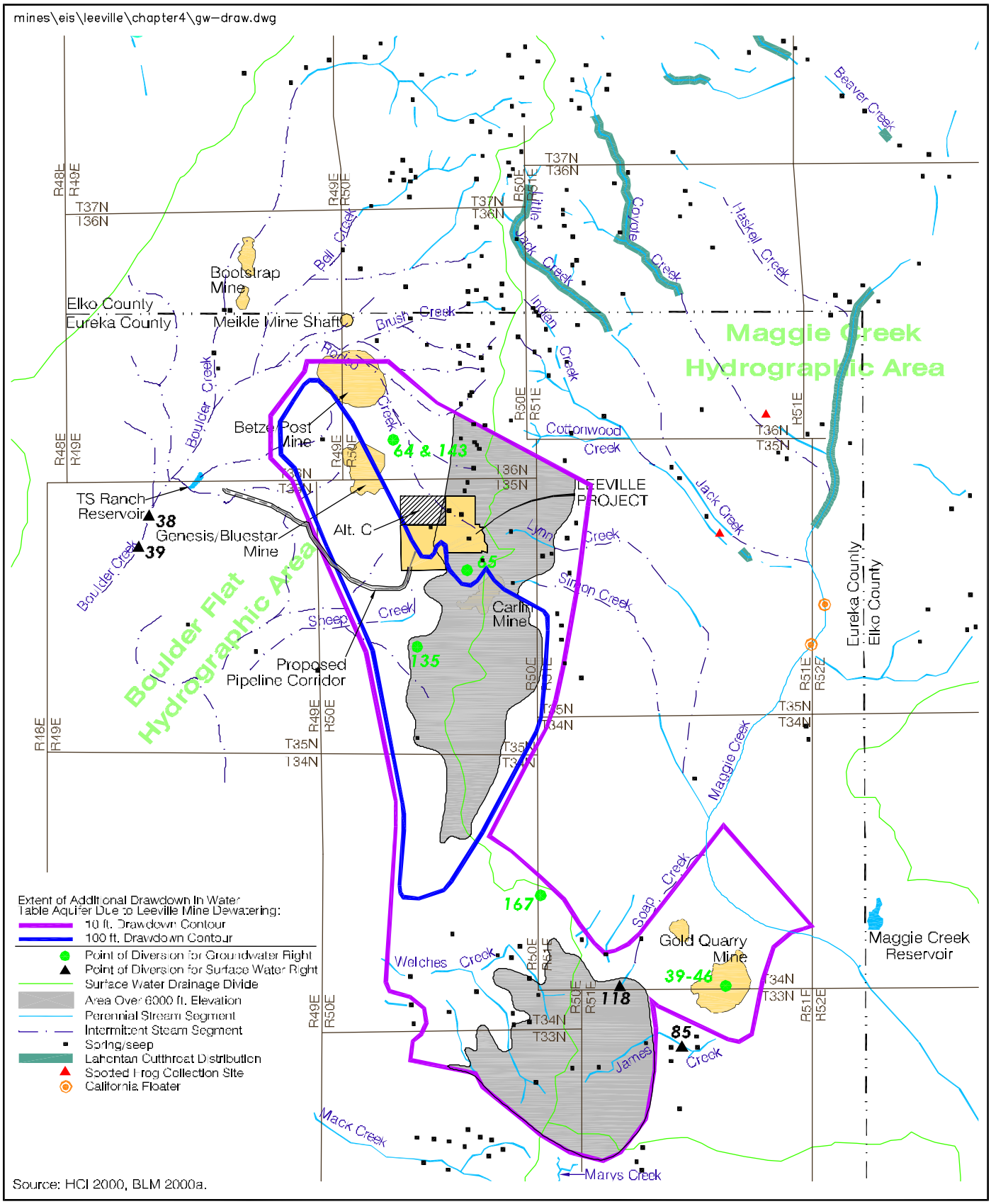
Impacts to Surface Water Quality

Excess mine water from Leeville's dewatering system would be transported via pipeline and canal to Barrick's Boulder Valley water management system. None of this water is expected to be discharged to streams or rivers. During the irrigation season, most of the water would be included in the Boulder Valley sprinkler and flood irrigation system. During the non-irrigation season, Leeville's excess mine water would be infiltrated at the TS Ranch Reservoir and other infiltration basins. Newmont's contingency for unexpected excess water from Leeville that cannot be used for irrigation and/or infiltration is to discharge to the Humboldt River using Barrick's existing pipeline and ditch system to a permitted outfall at the river (see outfall on **Figure 4-3**). In order for Newmont to use this outfall, however, it must receive prior authorization from the State Engineer (per Ruling 5011). **Table 3-11** includes information on rates and volumes of potential discharges to the Humboldt River for the Leeville Mine, Gold Quarry Mine, and Goldstrike Property.

For the proposed Leeville Mine, quality of water from the dewatering system was calculated using laboratory analyses of samples collected from two dewatering wells completed in lower plate rock at the Leeville Mine site (**Table 4-5**). Chemical concentrations from the wells were weighted to reflect the estimated percent contribution of groundwater from each identified hydrogeologic zone. The calculated average concentrations were then assumed to approximate the average concentrations in mine water from the Leeville dewatering system.

Results of groundwater mixing presented in **Table 4-5** show that arsenic (0.134 mg/L) in discharge water would not meet the drinking water standard of 0.05 mg/L; however, water would meet the aquatic life standards for arsenic of 0.18 mg/L (96-hour average) and 0.342 mg/L (1-hour average) Cadmium in the mixed groundwater would not meet one of the aquatic life standards of 0.0013 mg/L (based on water hardness of 150 mg/L).

Other parameters shown in **Table 4-5** with corresponding water quality standards would meet the standards for both drinking water and aquatic life. Temperature of groundwater



Additional Groundwater Drawdown
In the Water Table Aquifer
Leeville Project
FIGURE 4-2

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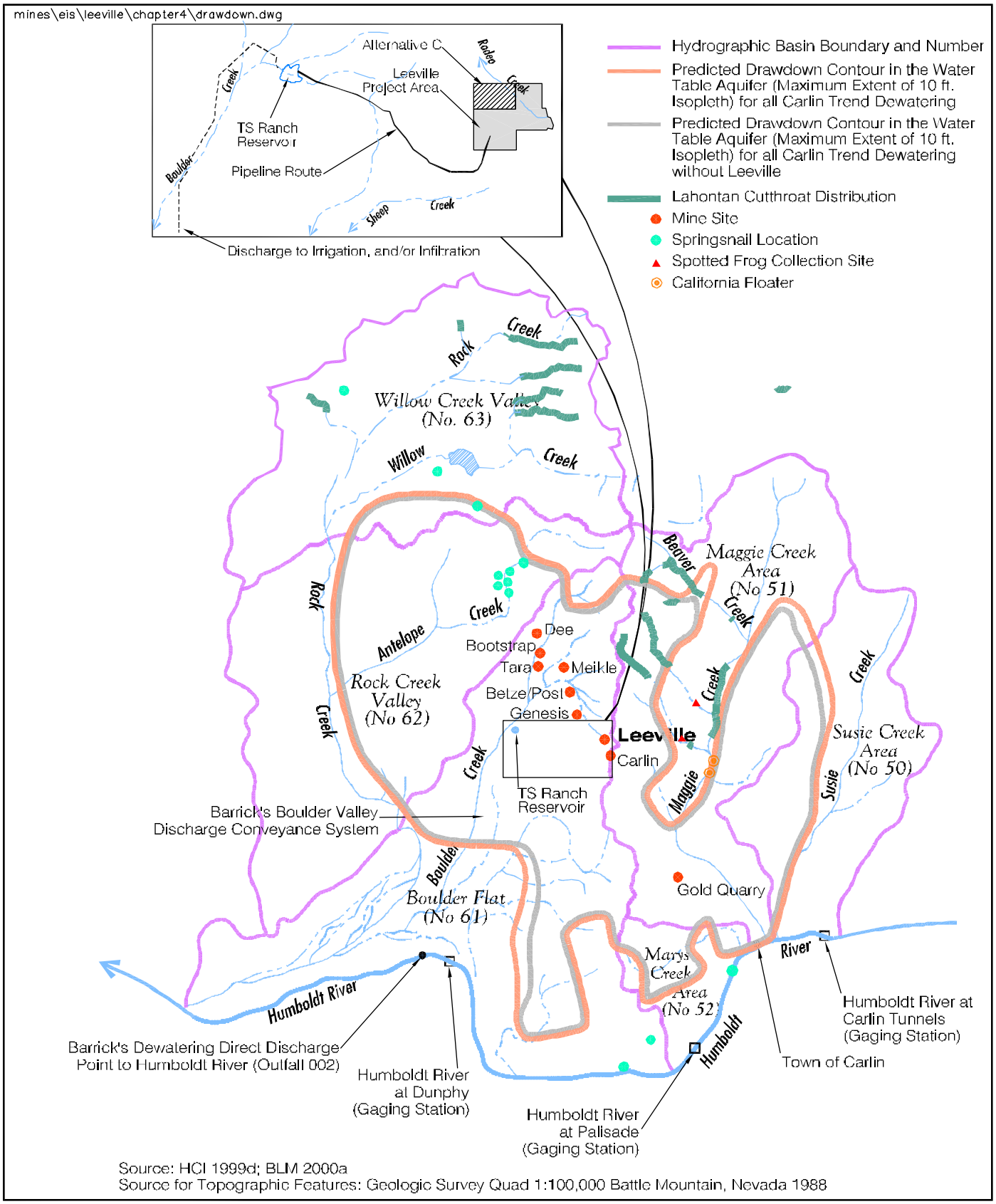

Maximum Lateral Extent of Groundwater Drawdown Area
Leeville Project
FIGURE 4-3

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pumped in the Leeville Mine area ranges from 67 to 87ºF. Any parameters that do not meet regulatory standards would be treated at the Leeville Mine, resulting in concentrations that would not adversely impact water resources and would meet NPDES permit limits.

Water that is treated and pumped from the Leeville dewatering system to TS Ranch Reservoir and other infiltration basins in Boulder Valley would temporarily be retained as surface water in impoundments; however, this water and some irrigation water would readily infiltrate to the groundwater system. Therefore, no impacts to surface water quality would occur. If all excess mine water from Leeville cannot be distributed via irrigation, infiltration, and/or injection, then some water may be discharged to the Humboldt River after approval from the State Engineer. Impacts that have occurred or could occur from discharge to the river have been evaluated in the Cumulative Impact Analysis report (BLM 2000a) and the Betze Project Draft Supplemental EIS (BLM 2000b). If water from Leeville is discharged to the Humboldt River, potential impacts would be similar to or less than those described in the two documents listed above.

All disturbed areas associated with the Leeville Project (e.g., refractory ore stockpile; waste rock facility; and production shaft area; **Figure 2-4**) would have surface water run-off and run-on control ditches. The system of run-off control ditches would collect surface water from disturbed areas, and run-on ditches would prevent water from undisturbed areas flowing over any disturbance. Run-off water would be collected in sediment ponds and used for dust suppression.

Minor increases in sediment may occur to upper Rodeo Creek during construction of road crossings. As stated in the *Water Quantity and Quality* section of Chapter 3, elevated concentrations of arsenic are present in Rodeo Creek. The Leeville Project is not expected to increase concentrations of arsenic or other constituents in Rodeo, Boulder, and Sheep creeks, or their tributaries because of best management practices (BMPs) that would be implemented for disturbed areas. Newmont (1995c; 1997a) would obtain a stormwater permit and utilize BMPs during construction and reclamation activities to prevent sediment input to the drainage channels. BMPs are defined by the Nevada State Conservation Commission (1994) and would include silt fences, straw bale dikes, temporary diversions, sediment basins, and other measures that would minimize exposure of disturbed materials to stormwater.

An erosion stability analysis was performed for the Leeville Project to estimate sediment yield for the post-mining landscape (Newmont 1997a). Reclamation measures used to reduce erosion would include revegetation of disturbed areas and regrading waste rock and surface facility areas. Results of sediment loss calculations using the Revised Universal Soil Loss Equation (RUSLE) show pre-mine erosion rates are up to 6.08 tons/ acre/year, and post-mine rates would be up to 2.53 tons/acre/year (Newmont 1997a). Refer to the *Soils* section in this chapter for more information regarding erosion potential.

Impacts to Springs and Seeps

Individual springs and seeps identified in the project area are shown on **Figure 4-2** in relation to additional groundwater drawdown area predicted for the Leeville Project. Approximately 40 springs/ seeps are located within the predicted drawdown area. However, groundwater drawdown predicted for Leeville as shown on **Figure 4-2** would occur within the cumulative cone of depression as shown on **Figure 4-3**. The springs/seeps either have already been impacted by regional mine dewatering or have not been impacted because they are associated with the shallow, perched water table system. Some springs flow only intermittently from seasonal precipitation events. Four springs located within the Leeville Project area boundary (**Figure 4-2**) would not be subject to surface disturbance by mine-related activities.

The additional volume of groundwater removed by Leeville dewatering may increase the recovery period by about 20 years after cessation of dewatering for springs/seeps that are affected by the cone of depression. During the dewatering period at Leeville, the additional water added to the TS Ranch Reservoir would allow Green, Knob, and Sand Dune springs to continue flowing.

Impacts to Groundwater Levels and Storage

The Carlin Trend model (HCI 1999a) was used to predict the magnitude and extent of groundwater drawdown over time resulting from dewatering at major mines located in the Carlin Trend (BLM 2000a). Groundwater drawdown currently totals over 1,500 feet in the Goldstrike Property area, and over 600 feet in the Gold Quarry Mine area.

Lowest water table elevation expected as a result of dewatering at Leeville Mine would be approximately 3,800 feet in the lower plate hydro-stratigraphic unit (i.e., carbonate rocks). Current groundwater elevations in the lower plate are approximately 4,800 feet in the Leeville area (**Figure 3-13** and **Table 3-17**). Therefore, this water level would be lowered an additional 1,000 feet immediately surrounding the underground workings. Dewatering at the Goldstrike Property and Gold Quarry Mine has already lowered water levels in the upper and lower plates in the Leeville area by 265 and 369 feet, respectively (HCI 1999b, **Table 3-17**).

TABLE 4-5
Representative Groundwater Quality for Dewatering at Leeville Project

Parameter[1]	Well HDDW-1A[3]	Well HDDW-2[3]	Combined Wells[4]	Aquatic Life Standards[5]	Nevada Standards for Municipal or Domestic Supply[6]
Number of Samples	4	4	8	---	---
Pumping Rate (gpm)[2]	18,000	2,000	20,000	---	---
Est. % of Total Water	90%	10%	100%	---	---
Hydrostratigraphic Unit	Lower Plate	Lower Plate	---	---	---
TDS[2]	305	321	307	---	500 - [1000]
pH (std units)	8.09 – 8.17	8.08 – 8.16	---	6.5 – 9.0	5.0 – 9.0
Temperature (°F)	86 – 87	67 – 70	---	ss[5]	---
Alkalinity (as HCO_3)	170	185	172	---	---
Calcium (Ca)	42.2	51.9	43.2	---	---
Sodium (Na)	10	13.1	10.3	---	---
Magnesium (Mg)	19.5	20.2	19.6	---	---
Potassium (K)	3.0	4.0	3.1	---	---
Chloride (Cl)	7.7	12.5	8.2	---	250 - [400]
Fluoride (Fl)	0.33	0.84	0.38	---	---
Sulfate (SO_4)	45.5	72.2	48.2	---	250 - [500]
Nitrate (NO_3)	<0.10	<0.10	<0.10	90 / 90	10
Antimony (Sb)	0.007	0.030	0.009	---	0.146
Arsenic (As)	0.068	0.726	0.134	0.342 / 0.18	0.05
Boron (B)	<0.10	<0.10	<0.10	---	---
Cadmium (Cd)	<0.005	0.009	0.003*	0.0053 / 0.0013	0.005
Chromium (Cr)	<0.05	<0.05	<0.05	0.015 / 0.01	0.10
Iron (Fe)	0.32	0.39	0.33	1.0 / 1.0	0.3 - [0.6] (s)
Manganese (Mn)	0.01	0.08	0.02	---	0.05 - [0.1] (s)
Mercury (Hg)	<0.001	<0.001	<0.001	0.002 / 0.000012	0.002
Selenium (Se)	0.005	0.004	0.005	0.02 / 0.005	0.05
Zinc (Zn)	0.01	0.06	0.02	0.14 / 0.127	5.0 (s)

1 All units in milligrams per liter (mg/L) unless otherwise specified. Metals are dissolved concentrations.

2 TDS = total dissolved solids; gpm = gallons per minute.

3 Samples were collected during the period of April 1996 – August 1997; values on table are the highest concentrations measured (see **Table 3-18** for range, mean, and standard deviation values).

4 Results of groundwater mixing are based on 90% from well HDDW-1A and 10% from well HDDW-2 as recommended by Paul Pettit of Newmont (personal communication); the value with an asterisk (*) for cadmium indicates that the less than value of <0.005 mg/L was set at half the value for calculating a resultant concentration.

5 See **Table 3-13** for listing of aquatic life standards; first value is the 1-hour average standard (propagation) and the second value is the 96-hour average standard (put and take). ss = site-specific determination for water temperature.

6 See **Table 3-13** for listing of water quality standards; numbers in brackets [ ] are mandatory secondary standards for public water systems; (s) indicates federal secondary drinking water standard.

Source: Newmont 1997b.

Results of numerical groundwater flow modeling described earlier in this section are presented on **Figures 4-2** and **4-3**. Area of potential concern with respect to declining water levels is the area predicted to have a change in elevation of 10 feet or more from mine dewatering. Changes in groundwater elevation of less than 10 feet are not considered adverse impacts because these changes are on the order of natural seasonal and annual fluctuations in groundwater levels. Drawdown results shown on **Figure 4-3** are cumulative from all Carlin Trend mine dewatering and, therefore, are discussed later in the *Cumulative Impacts* section.

Figure 4-2 shows contours that depict additional vertical drawdown that would occur in the water table aquifer (primarily lower plate rocks) from Leeville Mine dewatering. The model predictions show the maximum extent of the 10-foot contour for additional drawdown that would be caused only by Leeville. This additional drawdown area is oriented primarily north-south along the hydrographic basin boundary between the Boulder Flat and Maggie Creek Area (**Figure 4-2**). Lateral dimensions of the area affected by 10 feet or more of drawdown due to Leeville dewatering are approximately 19 miles by 9 miles. For the area predicted to have more than 100 feet of drawdown, dimensions are approximately 11 miles by 4 miles (**Figure 4-2**).

The upper plate rocks (siltstone) at Leeville are generally not in direct hydraulic contact with the underlying lower plate rocks (carbonate). Most dewatering volume from Leeville would occur from lower plate rocks; therefore, drawdown in upper plate rocks would be limited. Lower plate rocks are exposed at the surface west and south of the Leeville site however, the plates are not differentiated on **Figure 4-2**. Additional groundwater drawdown as a result of Leeville pumping would be greater than 100 feet in that area (i.e., lower plate rocks).

A total of approximately 360,000 acre-feet of groundwater would be pumped during the proposed mining period for the Leeville Project. This would reduce the amount of groundwater present in the Boulder Flat and Maggie Creek hydrographic basins; these are the areas primarily affected by dewatering at Leeville (**Figure 4-2**). Some of the removed groundwater would be replaced by groundwater inflow from surrounding areas. In addition, a majority of the removed water would be returned to the Boulder Flat hydrographic basin using irrigation, infiltration basins (including TS Ranch Reservoir), and possibly injection wells. Of the water applied to irrigation, about 30 percent of the volume is assumed to reach the groundwater system.

Total volume of water predicted to be pumped from dewatering systems at Goldstrike Property and Gold Quarry Mine is 1,085,000 and 595,000 acre-feet, respectively (BLM 2000a). Therefore, Leeville dewatering (360,000 acre-feet) would represent about 18 percent of the total water volume to be pumped from the three Carlin Trend mines. According to Maurer et al. (1996),the Boulder Flat hydrographic area receives about 14,000 acre-feet per year of natural recharge. Total reinfiltration volume of excess Leeville Mine water would be about 212,000 acre-feet for the life-of-mine (BLM 2000a).

Assuming an 18-year mine life for Leeville, an average water volume of 20,000 acre-feet per year (12,400 gpm or 28 cfs) would be removed using dewatering wells, and 11,800 acre-feet per year would be infiltrated back into Boulder Valley, assuming a 30 percent return of irrigation water to the groundwater system (**Table 3-11**). Therefore, average net groundwater loss due to Leeville dewatering would be 8,200 acre-feet per year (5,000 gpm), or 40 percent of total water withdrawal, for the 18-year mine life. This water loss would be a result of consumption from mining-related activities, evapotranspiration, and discharge to the Humboldt River (if necessary). During the first 2 years of dewatering at Leeville, pumping rates are predicted to be double the average annual values presented above (also see **Figure 3-7**).

After cessation of mining and dewatering in the Carlin Trend, the groundwater drawdown area would begin to recover to premine conditions. The additional water removed by the Leeville Project is expected to extend recovery time by 1 to 20 years, depending on location in the cone of depression. This results in Leeville adding 4 to 6 percent to the total recovery period for Carlin Trend dewatering. Based on results of the groundwater flow model, recovery of the lower plate water level would begin in about 2020 and continue for more than 100 years (HCI 2000). Recovery of groundwater in the upper plate would begin earlier because dewatering of the upper plate at Leeville would terminate approximately 4 years after initiation of mining and dewatering.

Some areas of Boulder Valley west and south-west of the Leeville Mine have experienced

increasing water levels in shallow hydrostratigraphic units (i.e., alluvium and Carlin Formation) due to infiltration of excess water from the Goldstrike Property in the vicinity of the TS Ranch Reservoir and irrigation systems. By the end of 1998, water levels in shallow bedrock and alluvium in the Boulder Valley had risen up to about 50 feet (Barrick 1999). This mounding of groundwater in Boulder Valley, if significant, may result in some limitations on infiltrating excess mine water in the TS Ranch Reservoir area.

As discussed in the *Geology and Minerals* section of this chapter, some areas in the vicinity of the Leeville site are potentially susceptible to sinkhole development in limestone. These areas in relation to projected drawdown contours caused by Leeville dewatering, are shown on **Figure 4-4**. Due to the significant depth to groundwater in this area already caused by regional mine dewatering, the additional drawdown caused by Leeville is not expected to cause development of sinkholes.

Impacts to Groundwater Quality

Mining and milling activities associated with the Leeville Project are not expected to impact groundwater quality beyond what may occur from current mine and processing operations in the area. Processing of ore from the Leeville Mine would occur at a currently permitted facility in the South Operations Area. This facility is designed to protect and monitor groundwater quality to prevent adverse effects (e.g., low permeability liner and monitoring wells). For potential impacts to water resources from the proposed refractory ore stockpile and waste rock facility at the Leeville site (e.g., acid rock drainage and leaching of metals), refer to the *Geology and Minerals* section in this chapter. During reclamation, the final waste rock facility would be regraded and vegetated to inhibit erosion, collection of surface water, and infiltration. No ore stockpiles would remain after reclamation. The septic drainfield to be constructed at Leeville is expected to operate properly and not impact water quality.

Minor short-term impacts to groundwater quality immediately surrounding the Leeville underground mine workings may occur as the water table rises (e.g., elevated nitrate from blasting residue). The lack of oxygen in the flooded underground mine, in addition to the removal of a significant amount of acid rock drainage producing material during mining, would inhibit development of acidic water conditions and associated leaching of metals. Most of the mined stopes would be backfilled with cemented rock fill consisting of neutral or acid-neutralizing material. Tests of waste rock to be generated at Leeville indicate the total mass of rock would be non-acid-generating; however, local zones of acid-generating waste material would be mined and encapsulated.

Meteoric water mobility tests show that some chemical constituents may be elevated (see *Geology and Minerals* section in this chapter).

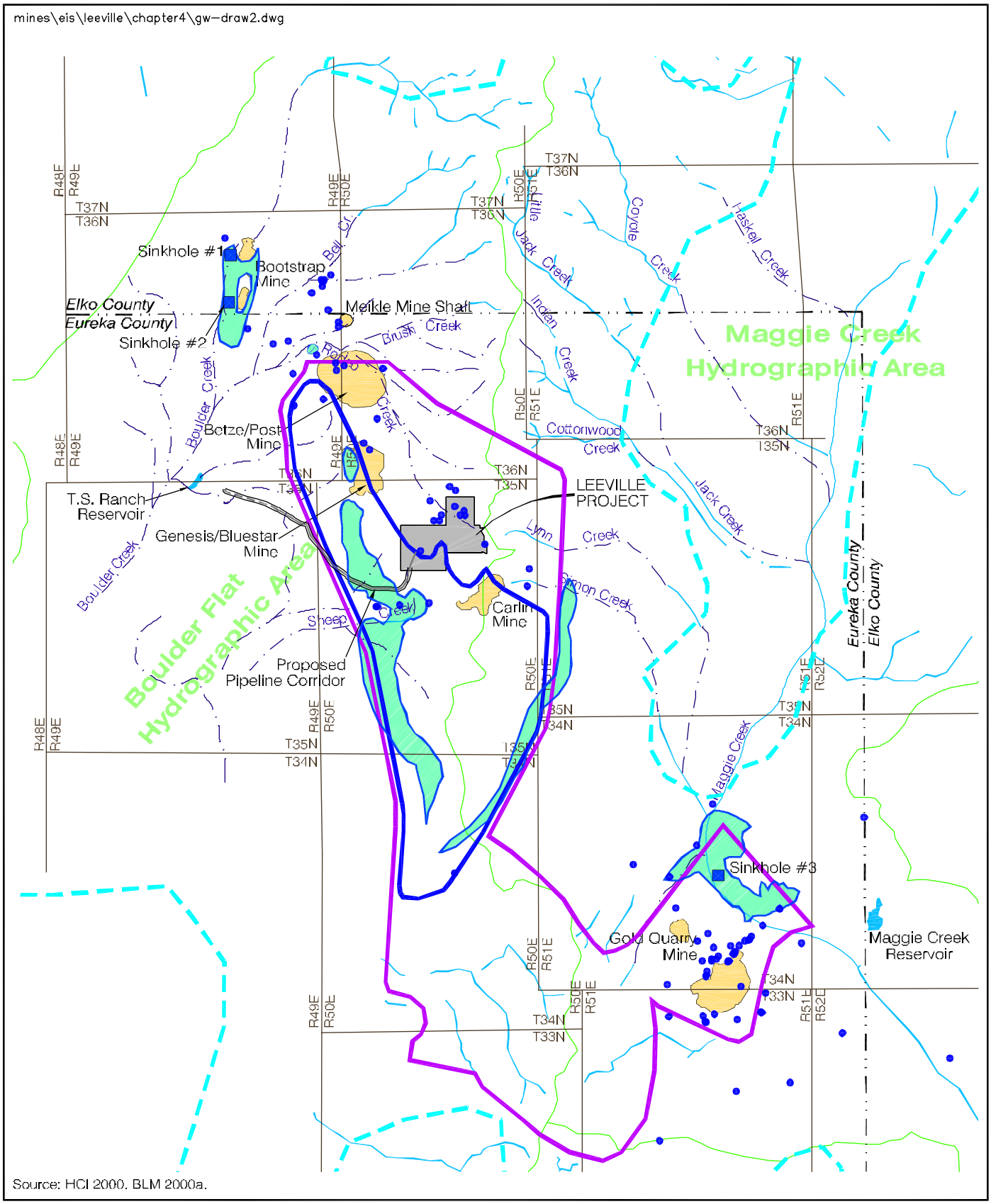
During advancement of the mine shafts within the first few years of Leeville operation, dewatering in the upper plate would prevent mixing of water in the lower plate. When the upper plate dewatering wells are turned off, concrete lining along the shaft wall is expected to prevent water inflow and mixing of upper and lower plate water zones. Pressure grouting methods may be used, if necessary, to control areas of discreet inflow.

Water quality characteristics are similar between the upper and lower plate hydrostratigraphic units (**Table 3-18**) and, therefore, if mixing did occur, it would not result in adverse quality impacts. Once the water level in the shafts reaches the contact between the upper and lower plates after termination of dewatering, the potential for water mixing is diminished. This may take 100 years or more of recovery, however.

Impacts to Water Rights

Impacts to individual water rights would depend on site-specific hydrologic conditions. For Leeville, additional groundwater drawdown would occur within the cone of depression that will continue to develop from dewatering at the Goldstrike Property and Gold Quarry Mine (**Figures 4-2 and 4-3**). **Table 4-6** lists groundwater rights located within the drawdown area that are shown on **Figure 4-2** for the direct impact area. Water rights are not required for most domestic wells. However, there are no known domestic wells in the Leeville Project area.

Impacts to groundwater rights resulting from Leeville dewatering could cause additional water table lowering in three stock-watering wells and two mining/milling wells (**Table 4-6**). Several other groundwater rights applied for by Elko County are in the Gold Quarry Mine area and would be affected primarily by dewatering at this mine. Specific impacts to individual wells would depend on factors associated with well completion, including well depth, pump setting, water yield, and cumulative effects from dewatering at other mines in the area.



Areas Potentially Susceptible to Sinkhole Development
Leeville Project
FIGURE 4-4

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TABLE 4-6
Water Rights Located Within Predicted Groundwater Drawdown Area

Map Location Number for Diversion Site[1]	Application/Permit Number and Status[2]	Owner of Record	Use	Comments[3]
Groundwater Rights				
39 – 46	57020 – 57027; RFP	Elko County	Recreation	10 – 100 ft added drawdown
64	28197; CER	Polar Resources Co.	Mining & Milling	10 – 100 ft added drawdown
65	30615; CER	Polar Resources Co.	Mining & Milling	>100 ft added drawdown
135	23881; CER	Newmont Gold Co.	Stock	10 – 100 ft added drawdown
143	28969; CER	Elko Land & Livestock	Stock	10 – 100 ft added drawdown
167	46044; CER	Elko Land & Livestock	Stock	10 – 100 ft added drawdown
Surface Water Rights				
85	45509; CER	Newmont Gold Co.	Stock	In Maggie Creek Basin
118	3474; CER	Charles Drake	Irrigation	In Maggie Creek Basin
38 – 39	3146 – 3147; CER	Almond Fox	Irrigation	In Boulder Valley just outside drawdown area

[1] See **Figure 4-2** for water right diversion sites.
[2] RFP = ready for action (protested); CER = certificate.
[3] For groundwater rights, comments indicate predicted additional groundwater drawdown that may occur in wells due to Leeville Mine dewatering.

Source: BLM 2000a

Adverse impacts to surface water rights could occur when dewatering at Leeville adds to ongoing decreases in surface water flow in the area as a result of Leeville contribution to the cone of depression. Surface water rights in the Leeville drawdown area are listed in **Table 4-6** and shown on **Figure 4-2**. One irrigation and one stock surface water right are located in the Gold Quarry Mine area. Two irrigation surface water rights are located along Boulder Creek about 3 miles downstream from the predicted drawdown area. Since drawdown has already occurred in the area shown on **Figure 4-2** from regional mine dewatering, additional drawdown caused by Leeville would have no direct or indirect effect on surface water rights except to lengthen the period of recovery by about 20 years. Additional surface water rights in the Leeville Project area are associated with the TS Ranch Reservoir which is currently supplied with water from Goldstrike Property dewatering systems.

Alternative A

Replacement of about 1 mile of lined open canal with a pipeline under Alternative A would eliminate approximately 5 gpm loss due to evaporation from the open canal.

Alternative B

Backfilling the production and ventilation shafts would be completed using approximately 166,000 cubic yards of waste rock from the Leeville Mine. As described in the *Geology and Minerals* section in this chapter, most waste rock from the Leeville Mine would not be potentially acid-generating (non-PAG). Backfill material, however, would have potential to leach some metals and adversely impact groundwater quality around the shafts on a short-term basis. Based on meteoric water mobility tests conducted on representative waste rock samples from Leeville, the following constituents could be elevated in water around backfilled waste rock: antimony, arsenic, manganese, nickel, selenium, and sulfate (see **Table 4-4**). Adverse impacts to groundwater quality surrounding Leeville Mine workings, however, should be negligible because (1) shaft would be lined with cement, and (2) background water quality (**Table 3-18**) surrounding the Leeville ore body has elevated concentrations of similar constituents.

Alternative C

This alternative would result in 118 acres less new disturbance which could reduce the amount of sedimentation during construction activities on undisturbed land.

No Action Alternative

The No Action Alternative would eliminate water-related impacts that would be attributed solely to the Leeville Project. Many of the impacts occurring in this area (e.g., groundwater drawdown and discharge of excess mine water), however, would continue as a result of disturbance and dewatering associated with other mines in the Carlin Trend.

Cumulative Impacts

Cumulative impacts area for water resources includes the following hydrographic areas: Boulder Flat (No. 61); Maggie Creek Area (No. 51); Rock Creek Valley (No. 62); Willow Creek Valley (No. 63); Susie Creek Area (No. 50); Marys Creek Area (No. 52); and Humboldt River from Carlin Tunnels gage to Humboldt Sink. BLM's Cumulative Impact Analysis report (BLM 2000a) contains a comprehensive analysis of impacts resulting from dewatering operations at Leeville Mine, Goldstrike Property, and Gold Quarry (i.e., South Operations Area) Mine. The latter two mines have ongoing dewatering operations that have resulted in a cone of depression in the Carlin Trend bedrock groundwater system. Also included in the Cumulative Impact Analysis report (BLM 2000a) is an analysis of impacts to Humboldt River flow from combined mine discharges and groundwater drawdown.

Continued dewatering at the Goldstrike Property and future expansions of Gold Quarry Mine, as well as the proposed Leeville Mine, would result in expansion of the groundwater drawdown area until after dewatering ceases. Infiltration of excess mine water in Boulder Valley from ponds and irrigation has resulted in an increase in groundwater levels in those areas. This situation also occurs to a lesser degree in Maggie Creek Valley from seepage at Maggie Creek Reservoir and along portions of lower Maggie Creek.

Continued groundwater drawdown in the Carlin Trend could adversely impact regional water levels in neighboring water wells and flow from spring and seeps. However, significant effects on monitored springs have not been observed to date. Most springs above 6000 feet occur from perched, shallow groundwater systems higher in the mountains not connected to deeper, regional groundwater systems affected by dewatering.

The predicted maximum extent of groundwater drawdown (based on 10-foot drawdown contour from the Carlin Trend model) in the Carlin Trend north of the Humboldt River is shown on **Figure 4-3**. This figure shows the drawdown area in the water table for two scenarios: (1) all Carlin Trend mine dewatering, including Leeville; and (2) Carlin Trend dewatering without Leeville. Comparing the two drawdown areas on **Figure 4-3**, shows that the Leeville Mine would expand the maximum drawdown area to a relatively small degree in three areas: central Boulder Flat, Maggie Creek Basin along a portion of Beaver Creek, and along the drainage divide between Maggie Creek and Susie Creek.

Using the Carlin Trend model, HCI (1999a) predicted the effects of Leeville dewatering on the baseflow of several streams, including Marys, Maggie, and Boulder creeks, and the Humboldt River. Baseflow conditions are assumed to occur around October when most flow in the drainage is attributable to groundwater discharge (i.e., precipitation and evapo-transpiration are at a minimum). Baseflow in all reaches of the Humboldt River in the study area, and in Maggie, Marys, and Boulder creeks is predicted to decrease by less than 0.1 cfs in each water body due to Leeville dewatering.

The cumulative flow reduction that may be caused by Leeville dewatering is predicted to be 0.1 cfs or less for Marys, Boulder, Maggie, and the Humboldt River. A reduction of 0.1 cfs in upper Maggie Creek is approximately 2.7 percent of the mean October baseflow of 3.7 cfs in the creek (USGS 2000). For all combined mine dewatering in the Carlin Trend, predicted maximum reductions in flow for streams potentially affected by Leeville dewatering on a cumulative basis would be: Humboldt River = 8 cfs; Boulder Creek = 0.1 cfs; upper Maggie Creek = 0.8 cfs; and Marys Creek = 1.9 cfs (BLM 2000a).

Maximum reductions in stream flow are predicted to occur approximately 10 years after cessation of dewatering, after which base flow conditions would begin to approach premine flows. On a cumulative basis, over 100 years will be required to achieve premine flow rates (BLM 2000a). Flows are predicted to gradually return to approximately 99 percent of historic annual volumes by year 2095 (BLM 2000a).

Of three areas that are predicted to have increased groundwater drawdown outside the drawdown areas for the Goldstrike Property and Gold Quarry Mine (**Figure 4-3**), only one area would potentially affect streamflow – the middle section of Beaver Creek. There are no flow data

for Beaver Creek; however, measurements for nearby Coyote, Spring, Jack, and Little Jack creeks show streamflow typically is in the range of 0.1 to 10 cfs in the upper reaches (Newmont 2001). Springs and seeps in the mountains maintain year-round flow in these stream sections. The lower reaches of these streams in the Maggie Creek valley bottom typically become dry after the spring run-off period.

Based on Carlin Trend model results, maximum impacts to baseflow in Beaver Creek, where the cone of depression would cross the stream (**Figure 4-3**), would be 0.05 cfs (HCI 2001). At higher elevations the two primary sources of water to mountainside streams such as Beaver Creek are direct run-off from precipitation that falls in the mountains and a shallow perched groundwater system. At lower elevations, the regional water table supplies the baseflow. Only that portion of baseflow supplied by the regional groundwater system could be reduced by 0.05 cfs.

Potential cumulative impacts to the Humboldt River from all mine discharges in the Carlin Trend and farther downstream have been evaluated in detail in BLM's Cumulative Impact Analysis report (BLM 2000a), Draft Supplemental EIS for the Betze Project (BLM 2000b), and Draft EIS for the South Operations Area Project Amendment (BLM 2000c).

Discharges from dewatering systems at Gold Quarry, Goldstrike, and Lone Tree Mines, to the Humboldt River have increased over time since the early 1990s to as much as 100,000 gpm (BLM 2000a). Discharge rates currently vary as the mines continue their water management programs. The overall water management goal in the Humboldt River basin is to minimize discharge to the river and retain water as infiltration back to groundwater in the affected local watersheds.

Modeling of projected future mine discharges, including Leeville, show that the largest percentage of increased flow in the river would occur in the lower flow months, and relatively little change would be observed during high flow months (BLM 2000b). Historic flow data for the Humboldt River show that post-1990 flows during the mine discharge period are within the range recorded historically (1946 to 1990) prior to mine discharges (BLM 2000b).

Any increases in Humboldt River flow from mine discharges are not expected to cause additional flooding, erosion, sedimentation, and changes in channel geometry. Excess mine water to the river would contribute to the stored volume in Rye Patch Reservoir and could raise concerns during high-flow years about the ability to provide emergency storage to minimize flooding and structural damage downstream.

Water quality from mine discharges in the Humboldt River basin generally have been within permit limitations. On an average annual basis, the mine discharges represent a loading increase in several constituents, including total dissolved solids, arsenic, boron, copper, fluoride, and zinc (BLM 2000b). This load increase, which would primarily affect Rye Patch Reservoir and Humboldt Sink, would be a relatively small incremental increase of total load in the river.

In November 1993, the BLM adopted for implementation the South Operations Area Project (SOAP) Mitigation Plan (BLM 1993b). Measures included in the SOAP Mitigation Plan and subsequent revisions to the Mitigation Plan in the SOAP Amendment (BLM 2000c) address potential adverse impacts from dewatering without regard to whether they occur on public or private land. Measures in the plan that deal directly with dewatering include extensive groundwater monitoring and reporting protocols. The monitoring data are used to trigger implementation of mitigation measures found in the plan, including flow augmentation for individual springs, seeps, and streams. Additional impacts to groundwater and surface flow attributable to the Leeville Project would be offset by these mitigation activities.

Potential Mitigation and Monitoring Measures

Monitoring of water resources in the vicinity of the Leeville Project is ongoing as part of the Boulder Valley and Maggie Creek Basin monitoring plans (Barrick 2000; Newmont 2001). Numerous surface water stations located on stream channels in the area (**Figure 3-6**) are used to monitor flow rates and water quality. Newmont also monitors six Rodeo Creek stations as part of its Water Pollution Control Permit in the North Operations Area. Numerous wells completed in the Leeville Mine area (**Figures 3-11** and **3-13**) are used to monitor

water level changes. Groundwater quality data would continue to be obtained from dewatering wells. Several springs also are routinely monitored by Barrick and Newmont in the Project area (**Figure 3-10**).

For all water resource monitoring in the Project area, the period of monitoring would be extended at least 18 years beyond monitoring schedules currently in-place (or proposed) for the Goldstrike Property and Gold Quarry Mine. In addition to the ongoing monitoring sites previously described in this chapter and Chapter 3 for surface water, groundwater, and springs/seeps, Newmont would develop a monitoring program specifically for its proposed waste rock dump and refractory ore stockpile. This monitoring program would include locations and schedule for water samples in the vicinity of these facilities.

In addition to wells currently monitored by Barrick and Newmont in the Project area, Newmont would periodically sample and analyze water from its dewatering wells for the Leeville Project. Other wells located near the Leeville site would be evaluated for possible monitoring.

For springs/seeps, Barrick is currently monitoring one of the four springs identified within the Leeville Project boundary (**Figure 3-10**). Newmont would develop an expanded monitoring program to include springs/seeps within and possibly near the Leeville Project boundary. Perennial springs in Beaver Creek would also be established as monitoring sites. Newmont would evaluate existing quality data for springs/seeps, and gather new data including tritium, to help determine which springs might be further affected by Leeville dewatering.

An additional surface water monitoring station on Sheep Creek downgradient of the Leeville site would be established. Newmont and BLM would evaluate the need to monitor Beaver Creek in Maggie Creek basin because of projected cumulative groundwater drawdown in that area caused by Leeville dewatering (**Figure 4-3**). Existing monitoring wells (i.e. HDP-12 and JKC-1) assess potential impacts to Beaver Creek. Other "step-out" wells may be needed to define extent of groundwater drawdown in this area. If any streamflow impacts could be attributed to Leeville, appropriate mitigation would be implemented.

Monitoring water resources, as described above, would continue until the water table has achieved 90 percent recovery or, until federal and state agencies determine it is no longer necessary. BLM would review and approve all monitoring plans for the Leeville Project and determine associated bond amounts. The monitoring program would be evaluated and revised periodically after review of water quality and quantity data, and updated numerical model results.

Mitigation measures may include additional BMPs if sedimentation from disturbed areas, and/or other surface water quality impacts become excessive in the drainages. If any water quality problems were to occur from the Leeville Project, (i.e., impacts detected at monitoring sites for surface water, groundwater, or springs/seeps), the situation would be evaluated for potential source(s) and the problem corrected. Such corrective action measures would be performed under the authority of state and federal agencies.

If mixing of upper plate and lower plate groundwater is detected in shafts or nearby monitoring wells at closure, Newmont would modify shaft backfilling operations to incorporate placement of fine-grained material across the contact zone between these two hydrostratigraphic units. Fine grained material could include cement, and/or clay to form a less permeable zone.

Irreversible and Irretrievable Commitment of Resources

Total volume of groundwater removed during life-of-mine dewatering operations at Leeville would be approximately 360,000 acre-feet. A small portion of this water would be consumed at the mine site and the remainder would be added to Barrick's existing Boulder Valley water manage-ment system. An estimated 212,000 acre-feet, or about 60 percent of the total dewatering volume, would be reinfiltrated into Boulder Valley via infiltration basins and irrigation systems. Proportions of this water that would go to various locations cannot be established at this time.

The remaining 40 percent of water volume (148,000 acre-feet) from the dewatering system that is not reinfiltrated would be consumed by mine-related activities, irrigation, evaporation (via infiltration basins), and possibly some discharge to the Humboldt River. With the exception of irrigation, this water represents a

permanent removal from Boulder Flat basin, and to a lesser degree, the Maggie Creek basin.

The Proposed Action would also increase the duration of some impacts to water sources within the overall regional groundwater drawdown area. This would include recovery of groundwater levels because of additional volume of water withdrawn by Leeville dewatering. Additionally, declines in stream baseflow for Maggie, Marys, and Boulder creeks, and the Humboldt River would be extended due to Leeville dewatering.

Compared to pre-mine conditions, overall recovery of water levels and stream flows would take over 100 years. Contribution from Leeville dewatering, however, would equate to about 20 years of recovery time extension, or adding 4 to 6 percent to the total recovery period for Carlin Trend dewatering.

Residual Adverse Effects and Impacts of Mitigation

Eventual recovery of groundwater levels after dewatering ceases in the northern Carlin Trend would allow impacts to wells and streams, if any, to diminish. This recovery period is expected to be more than 100 years. No other residual adverse effects on water resources are expected from the Leeville Project. No adverse impacts associated with mitigation activities are expected for water resources.

SOILS

Summary

The proposed Leeville Project, which includes underground workings, above-ground waste rock disposal facility, ore stockpile, roads, water discharge pipeline/canal system, and other surface support facilities would result in approximately 486 acres of surface disturbance. Potential impacts on soil resources include loss of soil during salvage and replacement, soil loss in stockpile due to erosion, and reduced biological productivity. These impacts are expected to be minimized, to the extent possible, following successful reclamation of a majority of the disturbed land. Some disturbed areas, such as rock faces and capped shafts, would not be reclaimed following completion of the Leeville Project. Loss of soil and interruption of natural soil processes and functions would be reversed by natural soil development over time. Reclamation efforts would expedite soil development.

Impacts resulting from implementation of Alternative A and/or B would be similar to those described for the Proposed Action. Impacts on soil resources resulting from implementation of Alternative C would be reduced commensurate with 118 acres less new surface disturbance.

Direct and Indirect Impacts

Impacts on soil resources occur in two separate stages during mining operations: 1) soil loss during mining, when salvaged topsoil is stock-piled and stabilized in storage areas; and 2) soil loss while stockpiled and during final topsoil redistribution and completion of reclamation. Although impacts to soil are greater during mining, topsoil erosion during and after topsoil redistribution has a greater effect on final reclamation.

Proposed Action

Direct impacts on soil resources from the Proposed Action would include modification to soil chemical and physical characteristics, loss of soil to wind and water erosion, and decreased soil biological activity over a surface disturbance of 486 acres. Chemical changes would result from mixing surface soil with subsoil during salvage activities, and reduce the amount of organic matter in surface soil. Impacts on physical characteristics of soil during salvage, stockpiling, and redistribution would include soil mixing, compaction, and pulverization from equipment and traffic. Soil compaction and pulverization would result in decreased permeability and water-holding capacity, and loss of soil structure and finer-grained soil material due to erosion.

Short-term soil loss associated with the Leeville Project would be greater than normal until vegetation becomes established. Soil loss from wind erosion is potentially high in Nevada's arid, windy climate. The potential for loss of salvaged soil would be greatest during reclamation after topsoil redistribution on disturbed areas. Potential for loss of subsoil would be greatest between initial disturbance and cover soil redistribution. The volume of soil loss would depend on wind velocity, size and condition of exposed area, and soil texture.

Water erosion potential could be high during heavy precipitation due to exposed soil, fine soil texture, soil surface conditions, and slope. However, management practices, such as mulching, addition of organic matter, interim seeding, or leaving slopes in a roughened condition would reduce losses.

Redistributed soil would have a lower organic matter content as a result of salvage and stockpiling. Soil biological activity would be reduced or eliminated during stockpiling as a result of anaerobic conditions created in deeper portions of stockpiles. After soil redistribution, biological activity would slowly increase and eventually reach pre-salvage levels.

Redistribution of soil during reclamation would result in soil loss and compaction from loading, hauling, and placement. Soil loss would continue until vegetation is established.

Newmont's Reclamation Plan (1997a) describes best management practices (BMPs) that would be used to reduce sediment loss from disturbed areas (e.g., silt fences, straw bales, water diversion, and settling basins) throughout the life of the Project and during post-reclamation activities. Mitigation measures that would be implemented by Newmont include salvaging suitable soil for reclamation and seeding soil stockpiles to establish vegetative cover. This would reduce potential soil loss from wind and water in the soil stockpiles. Reclamation activities designed to reestablish premining topographic contours would use topsoil and grass species that enhance the percentage of ground covered with vegetation (Lewicki 1997). Newmont would perform interim and, when possible, final reclamation concurrently with mining activities (Newmont 1997a). Such measures would reduce the duration of time that soil is exposed to erosional elements.

Soil loss from erosion from the Leeville Project site was predicted using the Revised Universal Soil Loss Equation (RUSLE) for both pre-mine and post-mine conditions (Newmont 1997a). The erosion analysis was conducted for seven cross-sections through the proposed mine area. Pre-mine site conditions include sparse upland vegetation dominated by sagebrush and rabbitbrush on slopes ranging from 15 to 40 percent north of Rodeo Creek and up to 50 percent south of the creek. Elevations range from 6,100 to 6,600 feet AMSL. For post-mining site conditions, a minimum of 12 inches of soil would be replaced during reclamation. Final revegetation cover after reclamation would be similar to the pre-mine site, but with a higher percentage of grass cover and a lower percentage of shrub cover.

With the exception of the waste rock disposal facility, the results of the RUSLE analysis show that soil erosion rates for the pre-mine conditions are higher than predicted erosion rates for the respective post-mine cross-sections. The erosion rates are up to 6.08 tons/acre/year for pre-mine conditions, and up to 2.53 tons/acre/year for post-mine conditions. According to the analysis (Newmont 1997a), the post-mine erosion is lower than pre-mine erosion due to two primary reasons: (1) the post-mine landscape would have a higher percentage of grass cover; and (2) post-mine topography would consist of short, steep slopes and long, mild slopes, while the pre-mine condition generally consists of long, steady slopes. The proposed waste rock disposal facility site is a special case since the original terrain has mild slopes of about 5 to 10 percent, while the post-mine condition would include steeper grades of about 35 percent.

Transportation and use of Hazardous Materials in the Project area could potentially impact soil resources. Impacts to soil resources would vary depending on location and substance(s) released/spilled. Newmont has implemented an Emergency Response Plan (Newmont 1995b) and Spill Prevention, Control, and Countermeasure (SPCC) plan (Newmont 1995c) to address accidental spills or releases of

Hazardous Materials. Accidental spills or releases due to malfunctioning components would be contained and remediated in accordance with these plans and applicable state and federal regulations.

Indirect impacts on other resources caused by soil disturbance from the Proposed Action include:

- Changes in water quality due to sedimentation from erosion of exposed slopes;
- Decreased vegetative productivity due to soil loss or inadequate cover soil depth;
- Impacts on hydric soil supporting wetland and riparian vegetation; and
- Decreased land utility.

Alternatives A and B

Impacts to the soil resource resulting from implementation of Alternative A and/or B would be similar to those described for the Proposed Action.

Alternative C

Impacts to the soil resource resulting from implementation of Alternative C would be reduced commensurate with 118 acres less new surface disturbance.

Cumulative Impacts

Because mining is expected to continue as a major activity in the Carlin Trend, impacts to the soil resource from mining, in addition to grazing, mine exploration, and other construction and restoration activities in the area, would continue to occur at various levels. Associated impacts from these activities would include loss of soil productivity due to changes in soil structure from mixing and handling, water and wind driven soil losses, water quality impacts due to sedimentation, and compaction from roads, construction, and livestock grazing. See **Table 4-1** for a list of existing and reasonably foreseeable mining disturbance and associated acres disturbed in the Carlin Trend.

Reclamation associated with past mining disturbance and future restoration activities would ameliorate soil loss and productivity loss. Soil salvaged and used in reclamation would become viable once vegetation is established.

Potential Mitigation and Monitoring Measures

Implementation of reclamation activities and BMPs outlined in Newmont's Plan of Operations would reduce potential soil loss associated with the Leeville Project. Newmont would recalculate potential soil loss using the RUSLE model and would input information from the Order II Soil Survey.

Irreversible and Irretrievable Commitment of Resources

Soil loss as a result of erosional or anthro-pogenic-caused forces is irreversible and irretrievable.

Residual Adverse Effects and Impacts of Mitigation

Loss of soil and interruption of natural soil processes and functions (e.g., soil development, infiltration, percolation, water holding capacity, structure, biological activity, and organic matter) can be reversed by natural soil development over an unknown period. Reclamation efforts would expedite those processes. Loss of vegetation productivity as a result of soil impacts and land uses could be reversed within 5 to 10 years after successful reclamation.

VEGETATION

Summary

Implementing the Proposed Action would result in disturbance of rangeland vegetation communities, consisting primarily of 10 vegetation types. Reclamation would occur on disturbed sites after mining activities cease, though some areas (e.g., rock faces) would not be reclaimed with soil and vegetation. Impacts resulting from implementation of Alternative A and/or B would be the same as those described for the Proposed Action. Impacts on vegetation resulting from implementation of Alternative C would be reduced commensurate with 118 acres less new surface disturbance.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would directly impact native vegetation at the mine site, along the discharge pipeline/canal route, and at ancillary facilities such as haul roads. Direct impacts include vegetation removal, soil compaction, and disturbance. Vegetation would be removed from approximately 486 acres. Proposed reclamation would reestablish vegetation on these sites.

Springs and seeps in the vicinity are shown in **Figure 3-10**. Four springs and seeps have been identified and mapped in the Project area as well as numerous springs and seeps to the north and east. **Figure 3-10** also illustrates perennial stream segments. There are no perennial stream segments in the Project area. The nearest perennial stream segments are in a portion of Sheep Creek and upper reaches of Simon and Lynn creeks; all approximately 1 mile from the Project area. Rodeo Creek drains the majority of the Project area. This stream is intermittent, flowing primarily during spring months (March–June). Nevada Division of Wildlife personnel report that Rodeo Creek is essentially 'a ditch' with no riparian vegetation or vegetated streambanks in the Project area (Lamp 2001).

Transportation and use of hazardous materials in the Project area could potentially impact vegetation resources. Direct impacts to vegetation resources and indirect impacts to livestock and wildlife would vary depending on location and substance(s) released/spilled. Newmont has implemented an Emergency Response Plan (Newmont 1995b) and Spill Prevention, Control, and Countermeasure (SPCC) plan (Newmont 1995c) to address accidental spills or releases of hazardous materials. Accidental spills or releases due to malfunctioning components would be contained and remediated in accordance with these plans and applicable state and federal regulations.

There would be a potential for noxious weed invasion or spread to disturbed sites (see following section: *Invasive, Nonnative Species*).

Alternatives A and B

Impacts associated with Alternatives A and/or B would be similar to those described for the Proposed Action.

Alternative C

Impacts on vegetation resulting from implementation of Alternative C would be reduced commensurate with 118 acres less surface disturbance.

No Action Alternative

Vegetation resources in the area would not be impacted by implementing the No Action Alternative since no ground disturbance associated with mining activities would occur. Impacts to vegetation associated with other ground disturbing activities in the area, including livestock grazing, would continue.

Cumulative Impacts

The cumulative impact area for vegetation resources encompasses areas disturbed by mining in the Carlin Trend. Cumulative impacts to the area's vegetation are directly related to those discussed in the *Soils* section above. Mine development, road construction, facility construction, and livestock grazing would impact vegetation on those sites.

Cumulative impacts to vegetation associated with wetlands/riparian zones would be expected as a result of dewatering activities associated with mining activity.

Past, present and reasonably foreseeable mining activity would result in disturbance of 32,962 acres, of which 6,412 acres are open

pits. Under BLM and NDEP permit requirements approximately 26,550 acres would be revegetated.

Potential Mitigation and Monitoring Measures

Potential mitigation measures include using locally adapted native seed for reclamation efforts accompanied by soil augmentation, if necessary, to improve chances of reclamation success. Shrub planting could be considered where appropriate and livestock exclusion on reclaimed areas would occur until vegetation has become established. A weed monitoring and control plan would be developed to ensure that reclaimed areas would be protected from noxious weed invasion. See *Grazing Management* section in this chapter for additional potential mitigation and monitoring measures.

Irreversible and Irretrievable Commitment of Resources

Vegetation productivity would be lost from disturbed sites until successful reclamation and revegetation efforts are completed.

Residual Adverse Effects and Impacts of Mitigation

As disclosed in the *Water Quality and Quantity* section, dewatering at the Leeville Mine is not expected to impact springs and seeps beyond what has or will occur from regional dewatering at the Goldstrike Property and Gold Quarry mines, however, recovery time for the water table would increase. This could increase recovery time for vegetation affected by drawdown. Residual impacts may remain in areas where reclamation would not occur, such as rock faces. No residual adverse impacts are foreseen from implementation of mitigation measures.

INVASIVE, NONNATIVE SPECIES

Summary

Implementing the Proposed Action would result in disturbance of 486 acres of rangeland vegetation. Construction activities such as roads, ancillary facilities, pipelines, production and ventilation shafts, exploration pits, and rock stockpiles would remove native sagebrush/bunchgrass communities and expose the areas to colonization by invasive, nonnative species. Establishment of noxious weeds can lead to ecological degradation. Impacts resulting from implementation of Alternative A and/or B would be the same as described for the Proposed Action. Implementation of Alternative C would result in 118 fewer acres of disturbance and less opportunity for establishment of invasive, nonnative species.

Direct and Indirect Impacts

Proposed Action

Soil disturbance provides an opportunity for noxious weed establishment. The Proposed Action would create approximately 486 acres of new disturbance resulting from mine development, exploration activities, construction of waste rock disposal facilities, refractory ore stockpile areas, discharge pipeline and canal system, and ancillary facilities.

Increased human activity could increase potential for wildfire, with subsequent spread of invasive annuals such as cheatgrass, and loss of native shrubs. Increased human presence would also increase likelihood that wildfires would be quickly controlled. Increased vehicle activity could increase potential for entry and spread of noxious weed species because weed seeds are often lodged in vehicle under carriages and tires.

Changes in grazing management practices associated with the Proposed Action could affect spread of noxious weeds. Elimination of grazing from mine properties through the life-of-mine would increase vigor of native shrubs and grasses, decreasing potential for weed infestations on undisturbed land.

Alternatives A and B

Impacts resulting from implementation of Alternative A and/or B would be similar to those described for the Proposed Action.

Alternative C

Impacts of invasive, nonnative species resulting from implementation of Alternative C would be reduced commensurate with 118 acres less new surface disturbance.

No Action Alternative

If the No Action Alternative were implemented, there would be no new impacts beyond those already present. Noxious weed populations could increase because of other non-mining related disturbance, such as grazing, road maintenance, recreation, and vehicle activity.

Cumulative Impacts

Impacts from an increase in invasive, nonnative species on the Project area would add to noxious weeds established throughout the Carlin Trend. Any additional increase incrementally decreases economic productivity and ecological integrity of the land.

Potential Mitigation and Monitoring Measures

Newmont would conduct annual weed surveys to direct weed control efforts. Monitoring infestations and weed control would continue until reclamation is complete and potential for weed invasion is minimized. Newmont's weed control efforts would be continued for the life-of-mine and reclamation period to reduce potential impacts of new infestations. Where straw bales are used for sediment control, certified weed free straw bales would be used.

Irreversible and Irretrievable Commitment of Resources

Where weed infestations are significant, they represent an irretrievable commitment of range productivity. During mining operations, infestations are not preventing use of the range because livestock would not be allowed to graze in the area. If noxious weeds are not controlled during reclamation, loss of range productivity would occur after mining and reclamation are complete.

Residual Adverse Effect and Impacts of Mitigation

Potential adverse impacts on some native plant communities could result from use of herbicides in a weed control program. Proper application of herbicides would reduce potential impacts to water and wildlife resources.

WETLANDS/RIPARIAN ZONES

Summary

Potential impacts to wetlands and riparian zones resulting from the Proposed Action would include an extension of the duration of water table drawdown (by about 20 years) created by existing dewatering operations in the Carlin Trend. This would delay restoration of up to 70 acres of wetlands and riparian zones located in the area of potential effect associated with Leeville dewatering.

Discharge of excess water from the Leeville dewatering system would infiltrate into the TS Ranch Reservoir, other infiltration basins, or would be used for irrigation in the Boulder Valley. This discharge would continue to support flow in three major springs located in the Boulder Valley (Sand Dune, Green, and Knob springs).

Direct and Indirect Impacts

Proposed Action

Dewatering activities at the proposed Leeville Project would remove additional groundwater from the cone of depression created by existing dewatering in the Carlin Trend and prolong water table recovery within the area directly affected by the Leeville dewatering system by approximately 20 years. This would result in a longer period of recovery for up to 70 acres of riparian vegetation potentially affected by Leeville dewatering. These 70 acres of riparian vegetation lie within the predicted area of direct

effect of Leeville dewatering (see **Figure 4-2**) below 6,000 feet elevation and include 40 acres of herbaceous streambar, 29 acres of wet meadow, and 1 acre of salexi-wet meadow. Information regarding the location of springs, seeps, and streams potentially affected by the Leeville dewatering system are described in the *Water Quality and Quantity* in this chapter.

Drying or reduced flow for springs, seeps, and streams, if any, would result in loss of riparian and wetland vegetation associated with these features. The type of impact and/or severity of the effect on springs, seeps, and stream reaches as a result of dewatering activities depends on the source of groundwater sustaining the feature and the degree of connectedness between surface water and deeper groundwater sources.

Restoration of flow to these sites would result in recolonization by wetland and riparian species.

Alternative A, B, and/or C

Impacts to wetlands and riparian zones associated with implementation of Alternatives A, B, and/or C would be similar to those described for the Proposed Action.

No Action Alternative

Implementation of the No Action Alternative would not impact wetlands/riparian zones in the Project area beyond those impacts that have or will occur as a result of other dewatering operations.

Cumulative Impacts

Cumulative impacts associated with dewatering and water management activities at the Goldstrike Property, Gold Quarry, and Leeville mines are included in the Cumulative Impacts Analysis report prepared by BLM (2000a). The hydrologic study area for cumulative impacts encompasses approximately 2,060 square miles (1.3 million acres) and includes six designated groundwater basins. Riparian habitat inventories within this area have identified and classified approximately 4,337 acres of riparian/wetland habitat (BLM 2000a).

Approximately 600 acres (14 percent) of the 4,337 acres of riparian vegetation occur within the area where perennial water could be impacted by cumulative groundwater drawdown. The remaining 3,737 acres of riparian vegetation within the cumulative effects area are considered less likely to be affected by groundwater drawdown (BLM 2000a).

Cumulative impacts to wetlands and riparian zones, including loss of wetland species would be expected as a result of dewatering activities associated with mining operations. Potential changes in structure and composition of riparian vegetation may occur as a result of long-term, cumulative groundwater drawdown within Carlin Trend watersheds.

Potential Mitigation and Monitoring Measures

No mitigation or monitoring measures are proposed beyond those presently being conducted by Newmont and those described in Potential Mitigation and Monitoring Measures in *Water Quantity and Quality* section of this chapter.

Irreversible and Irretrievable Commitment of Resources

No irreversible and irretrievable commitment of wetlands and riparian zone resources would occur as a result of the Proposed Action.

Residual Adverse Effects and Impacts of Mitigation

Dewatering associated with the Leeville Project is not expected to impact wetlands and riparian zones beyond what has or would occur from regional dewatering at the Goldstrike Property and Gold Quarry Mine, except to extend the period of recovery by about 20 years. There would be no residual adverse effects to wetlands and riparian zones associated with the Leeville Project from implementation of mitigation measures.

FISHERIES AND AQUATIC RESOURCES

Summary

No fisheries or aquatic resources have been identified in the Leeville Project area where land disturbance is proposed; therefore, implementation of the Proposed Action or Alternatives would have no direct impact on these resources in the proposed mine area. Dewatering activities at Leeville would prolong water table recovery within the area affected by Leeville's dewatering by approximately 20 years. This would result in a longer period for recovery of stream flow potentially reduced by current dewatering operations in the Carlin Trend; thus lengthening the recovery period of any impacted aquatic habitat in these streams.

Direct and Indirect Impacts

Proposed Action

No direct impacts to aquatic habitat or fisheries are expected within the project boundary as a result of the Proposed Action or any of the Alternatives. Construction activities for the Leeville Mine would be in the headwaters of Rodeo Creek where flow is intermittent or ephemeral and no aquatic habitat or fisheries have been documented.

Dewatering activities at the proposed Leeville Project would prolong water table recovery to within 90 percent of the premining water table elevation within the area affected by Leeville's dewatering by approximately 20 years. This would result in a longer time period for recovery of stream flow potentially reduced by current dewatering operations in the Carlin Trend; thus lengthening the time for recovery of any impacted aquatic habitat in these streams. Streams included in the direct impact area associated with the Leeville Project dewatering system include upper Simon Creek, upper Lynn Creek, and middle Maggie Creek (the Narrows), Rodeo, Sheep, Soap, Welches, Marys, James, and Cottonwood creeks (see **Figure 4-2**).

The additional 20-year recovery period to establish 90 percent of the premining water table condition represents a 4 to 6 percent increase in the predicted recovery period associated with cessation of pumping for current dewatering systems in the Carlin Trend. The extension of the recovery period would not result in any new or different impacts than those that could potentially result from existing dewatering activities.

Alternatives A, B, and C

Impacts resulting from implementation of Alternatives A, B, and/or C would be similar to those described for the Proposed Action.

No Action Alternative

Under the No Action Alternative, Newmont would not be authorized to develop the defined ore reserves or undertake any of the previously described associated activities. Potential impacts to fisheries and aquatic resources projected to result from development of the Leeville project would not be realized. Impacts from ongoing mine dewatering in the Carlin Trend would continue.

Cumulative Impacts

The cumulative impacts area for fisheries and aquatic resources includes the Maggie Creek drainage; portions of the Susie Creek drainage; Boulder, Antelope, Rodeo, Brush, and Bell creeks in the Boulder Valley and the Little Boulder Basin; and the Humboldt River from Carlin to Palisade. The cumulative impacts area evaluated for the threatened Lahontan cutthroat trout includes the Maggie Creek drainage, portions of the Susie Creek drainage, and the Humboldt River from Carlin to Palisade (see *Threatened, Endangered, Candidate and Sensitive Species* section in this chapter).

Potential cumulative impacts to these resources would include degradation of aquatic habitat from livestock grazing, mining (dewatering activity), roads, wildfire, and in some cases agricultural diversions. With the exception of the Maggie and Marys creek subbasins, most Lahontan cutthroat trout streams in the Humboldt River basin are generally declining in

habitat quality due to the aforementioned reasons (A. A. Rich and Associates 1999; BLM 2000a). However, no impacts caused by mine dewatering have been documented to date.

The magnitude of base flow reduction to area streams (e.g., Marys, Maggie, Beaver, and Boulder creeks and the Humboldt River) resulting from the addition of Leeville dewatering to existing dewatering in the Carlin Trend is predicted to be 0.1 cfs or less for each stream or river segment identified above. A reduction of 0.1 cfs or less for flow in Maggie Creek is 2.7 percent of the mean October baseflow of 3.7 cfs in the creek as measured Maggie Creek Canyon (USGS 2000). For combined mine dewatering in the Carlin Trend, predicted maximum reductions in flow for streams potentially affected by Leeville dewatering on a cumulative basis would be: Humboldt River = 8 cfs; Boulder Creek – 0.1 cfs; upper Maggie Creek = 0.8 cfs; and Marys Creek = 1.9 cfs (BLM 2000a) (see *Water Quantity and Quality* section of this chapter).

Maggie Creek Watershed Restoration Project has improved riparian and stream habitat since 1993. The program was designed to enhance 1,982 acres of riparian habitat, 40,000 acres of upland watershed, and 82 miles of stream channel in Maggie Creek Basin (BLM 2000c).

In November 1993, BLM adopted the South Operations Area Project (SOAP) Mitigation Plan in conjunction with the Final EIS, Newmont Gold Company's South Operations Area Project (BLM 1993b). The cumulative impacts area for SOAP coincides with the Leeville Project. Measures included in the SOAP mitigation plan address potential adverse impacts, including dewatering impacts, without regard to whether they occur on public or private land. These measures are designed to provide not only protection of natural resources but also improvement of most resources in the area, including aquatic habitat. Measures in the plan that deal directly with dewatering include extensive groundwater monitoring and reporting protocols. Monitoring data are used to trigger implementation of mitigation measures, including streamflow augmentation, for individual springs, seeps, and streams if and when the cone of depression impacts groundwater recharge to those water resources (see Maggie Creek Streamflow Augmentation Plan (BLM 1993b)). Full implementation of the SOAP mitigation plan would have a beneficial impact to fisheries and aquatic resources, including Lahontan cutthroat trout, in the cumulative impact area.

Dewatering at the Leeville Mine would extend the recovery period of regional groundwater levels. Impacts to groundwater and surface flow attributable to the Leeville Project would be offset by these mitigation activities.

Potential Mitigation and Monitoring Measures

Newmont's ongoing mitigation activities in upper Maggie Creek drainage as described above (BLM 1993b) are designed to reduce potential impacts of Newmont's South Operations Area Project on fisheries and aquatic resources. Newmont and BLM continue to monitor performance of this restoration project including riparian areas, aquatic habitat, and streamflow. Newmont in conjunction with BLM, is currently revising the SOAP Mitigation Plan to address potential impacts associated with the proposed amendment to the SOAP Plan of Operations.

Water monitoring activities by Newmont and Barrick would continue in the Project area. The Leeville Project would require extending the duration of monitoring programs commensurate with the predicted delay (approximately 20 years) in recovery of the water table. Additional monitoring wells and springs would be added to the monitoring network as described in the *Water Quantity and Quality* section in this chapter.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of fisheries and aquatic resources are predicted to result from implementation of the Proposed Action and Alternatives.

Residual Adverse Effects and Impacts of Mitigation

As discussed previously, mine dewatering has the potential to reduce surface water flow in some area streams where there is connection between groundwater and the stream. Residual impacts that could be associated with the Leeville Project include potential increase in the recovery period for groundwater levels. These residual impacts would exist under any of the action alternatives. Successful implementation of mitigation described above would offset residual impacts.

TERRESTRIAL WILDLIFE

Summary

Direct impacts to terrestrial wildlife resulting from the Proposed Action at the Leeville Mine site would be loss of habitat and the subsequent displacement or loss of wildlife. Direct loss of wildlife habitat would eliminate cover (nesting, hiding, and thermal), breeding sites, and forage. Most of the affected habitat within the Project area consists of sagebrush/bunchgrass communities. Construction of new haul roads, ancillary facilities, and mine development would result in 486 acres of habitat loss.

Loss of 486 acres of primarily sagebrush habitat would directly impact wildlife using that habitat, including pronghorn antelope, mule deer, small mammals, reptiles, and birds. Other direct impacts include potential vehicle collisions (birds, mammals, reptiles), powerline collisions (birds), and drowning in the proposed canal (small mammals, reptiles). Indirect impacts to wildlife include potential alteration and loss of riparian habitat, primarily off site. Although most of the Project area is marginal habitat for many species, and has already been affected by other mining related activities in the Carlin Trend, impacts to wildlife are expected.

Implementation of Alternative A would eliminate the potential physical hazard posed to wildlife along 5,700 feet of open canal between the mine and the existing water treatment plant near the TS Ranch Reservoir. Implementation of Alternative B or C would result in impacts on terrestrial wildlife similar to those described for the Proposed Action.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would result in incremental surface disturbance of approximately 486 acres, including 453 acres of public land and 33 acres of private land. Terrestrial wildlife currently inhabiting this area would likely be displaced during construction and mining activities.

Species with low mobility, such as some reptiles and small mammals, would most likely die during the initial disturbance activities. Wildlife with greater mobility, or that use the area as part of their home range, would be displaced to adjacent habitat. Animals also may be displaced from habitat adjacent to disturbed acreage by increased activity, noise, and dust. Eventually, some animals may adapt to and re-inhabit undisturbed areas. As reclamation occurs, wildlife populations would re-inhabit the area. As reclamation vegetation matures and begins to resemble the original vegetation in composition and density, wildlife use of the area may approach that of pre-disturbance .

Though all of the Project area lies within potential mule deer range, much of the area is sub-optimal, or has been impacted by other mining activities in the Carlin Trend, and therefore use is low throughout most of the year (Gray 2001). The eastern part of the Project area lies within mule deer transitional range. Most of the mule deer that migrate through the area, moving between summer ranges to the north and winter ranges to the south, now use the eastern flanks of the Tuscarora Range (BLM 1993a; Gray 2001). An unknown number of migrating deer (though a small percentage of the total migrating deer) do pass through the Rodeo Creek drainage and would be directly displaced by the Proposed Action (Gray 2001). Potentially greater levels of stress, increased competition with other mule deer, and potentially lower nutritional levels upon reaching winter range, may impact a small percentage of mule deer migrating through the area. A small but unquantifiable addition to mule deer mortality may occur because of these factors. An increase in mule deer mortality caused by collisions with vehicles would be expected as a direct result of higher volumes of traffic associated with mine development in the immediate mine area. Despite an increase in direct mortality, and a displacement of some mule deer from a part of their range, impact to the mule deer population attributable to activities associated with the Leeville Project is small.

The higher elevations of the Project area, including the area where mining and most ancillary facilities would occur, is relatively poor pronghorn antelope habitat and is not inhabited by pronghorn (Gray 2001).

A 42-inch diameter steel pipeline would be constructed for transporting water from the Project site to the existing Boulder Valley water management system. The pipeline would be buried except in rock areas, where trenching would be impractical. A buried pipeline would minimize interference with movements of terrestrial wildlife in the Project area.

The last segment of the pipeline and canal system would be comprised of a 5,700-foot long open canal terminating at the TS Ranch Reservoir. The canal would pass through flats in the Boulder Valley that are crucial summer range for pronghorn antelope (Gray 2001). Habitat loss from construction of the canal, and disturbance associated with monitoring and maintenance activities, would directly impact pronghorn using this area, and would increase cumulative impacts to this herd.

The proposed canal would be constructed to an average depth of 3.5 feet and lined with a geotextile liner. The canal would have a nominal bottom width of 15-feet with sloping sides of 3H:1V. No fencing is proposed to exclude wildlife or livestock from the canal. The open canal could cause disruption of pronghorn antelope movements and drowning of animals, including mammals, birds, and reptiles would occur.

A minor loss of upland habitat (steep, rocky slopes) suitable for chukar would occur as a result of the Proposed Action. The surrounding area provides habitat in ample abundance so that habitat losses caused by the Proposed Action would not likely disrupt chukar populations.

Low density populations of Hungarian partridge are widely distributed in the area. Loss of habitat as a result of the Proposed Action would be minor because adequate suitable habitat is available in the surrounding area. Prime habitat for mourning doves does not exist within the Project area and, therefore, would not be impacted by the Proposed Action.

Effects to migratory shorebirds and waterfowl would be minimal. The mine water sump would be approximately one acre of open water, when full, in an area of high disturbance, and would provide no food source. Thus, its value as a waterfowl and shorebird attractant would be minimal.

Impact to nongame birds and terrestrial reptiles would include direct loss of 486 acres of upland habitat, reducing forage and nesting habitat. As the amount of habitat lost compared to that available is minor, impacts are expected to be minor. No impact to amphibians is expected.

Raptors would be moderately affected by the Proposed Action due to a possible reduction in prey base caused by the loss of 486 acres of upland habitat. Because most raptors range over a large area, it is difficult to quantify how detrimental the loss of habitat would be. Due to the relatively small acreage affected, loss of prey base would probably be minor and raptor diversity in the area would likely remain unchanged.

Relocation of the existing powerline in the Leeville Project area would not result in measurable impacts to terrestrial wildlife. The configuration of the poles would remain the same as the current transmission line.

Effects of noise on wild animals can be classified as those affecting auditory physiology and sensory perception, those affecting behavior, and those affecting populations (Bowles 1995). Physiological and sensory perception in wildlife is not likely to be affected by noise generated by a mining operation. Wild animals can move away from a disturbance, and negative impacts to physiology or sensory perception are generally from chronic exposure. Many noises generated by mining operations are likely to be sporadic, impulsive, and fluctuating in intensity and duration. Potential impacts to wildlife include 'masking' of sounds made by predators, increasing the risk of predation, and 'masking' of social signals. Fluctuating noise levels may elevate heart rate, catecholamine levels, and corticosteroid levels in wild animals for short periods of time, but these elevated levels are generally of short duration, and animals often habituate to these disturbances over time. Short term increases of these measures do not correlate well with stress level experienced by the animal (Bowles 1995). Noise is an environmental stressor, and with repeated exposure all vertebrate animals habituate, or adapt behaviorally and physiologically (Bowles 1995).

Behaviors that may be impacted by noise include habitat use, courtship and mating, predator avoidance, and migration (Bowles 1995). Ungulates typically avoid areas where noise is present and return when it is not. A study conducted by the Idaho Game and Fish Department concluded that human harassment and simulated noise generated by mining activity caused elk to abandon traditional calving areas. Some cow/calf pairs moved several miles in response to disturbance, often into sub-optimal habitat (Kuck et al. 1985). If noises are of brief duration and the animal has good cover, change in home range size is not detectable. If mammals are repeatedly exposed to the same noise without harassment, responses to noise decline rapidly (Bowles 1995). Migration routes are not affected by noise, although short detours may increase energy expenditure (Bowles 1995).

No detectable changes in wildlife population size or growth rate have been documented due to noise. Most effects of noise disturbances are relatively mild (Bowles 1995).

Dust, heavy equipment exhaust fumes, and other air pollutants may render some vegetation unpalatable to some species, causing wildlife to be temporarily or permanently displaced. The extent to which wildlife would be impacted by these factors would be minor. No impacts to wildlife are expected from movement and storage of hazardous materials at the Leeville Project. Hazardous materials would be transported to the Leeville Project by United States Department of Transportation (USDOT) regulated transports and stored onsite in USDOT approved containers.

Alternative A

Implementation of Alternative A would eliminate exposure of wildlife to physical hazards associated with 5,700 feet of open canal. Water discharged from the mine into the pipeline and canal system would be treated to meet water quality standards (see *Water Treatment Facility* description section in Chapter 2).

Alternative B and/or C

Implementation of Alternative B and/or C would result in impacts to terrestrial wildlife similar to those described for the Proposed Action.

No Action Alternative

Under the No Action Alternative, Newmont would not be authorized to develop defined ore reserves or undertake any of the previously described associated activities. Potential impacts to terrestrial wildlife resources from development of the Project would not be realized. Impacts from ongoing mine activity in the Carlin Trend would continue under the No Action Alternative.

Cumulative Impacts

Cumulative impacts to terrestrial wildlife from activities in the area include those related to roads, haul truck traffic, habitat loss from mining, construction of ancillary facilities, dewatering activities, and water conveyance canals. The cumulative impact area extends from the Duck Valley Indian Reservation in the north to the Crescent Valley in the south.

The amount of reduced streamflow due to Leeville dewatering is predicted to be 0.1 cfs or less in each of Marys, Maggie, Beaver, and Boulder creeks and the Humboldt River. This reduction in baseflow would not adversely affect terrestrial wildlife.

Past, present, and future mine dewatering could reduce the amount and extent of available surface water and associated riparian habitats, including springs and seeps, in Maggie, Marys, and Boulder sub-basins, and along the Humboldt River. The magnitude of potential flow reduction is described in the *Water Quantity and Quality* section in this chapter.

Potential reduction or loss of available water, and the associated long-term changes in riparian vegetation, would result in a reduction of breeding, foraging, and cover habitats; increased animal displacement; reduction in overall plant and animal diversity; and possible long-term reduction in population numbers of some species (BLM 2000a). As vegetation changes occur, the incremental habitat loss would affect big game, upland game birds, waterfowl, shorebirds, raptors, songbirds, bats, and area reptiles and amphibians.

Cumulative impacts from habitat loss associated with open pits in the Carlin Trend can be attributed to the loss of approximately 4,800 acres of native rangeland due to existing and foreseeable mine disturbance (**Table 4-2)**.

Additional habitat loss (approximately 486 acres) due to road and facility construction would occur. While it is acknowledged habitat reduction has and would continue to occur in the Carlin Trend area, overall impact to the majority of native terrestrial species populations throughout north central Nevada would not likely be significantly adverse. However, development of the Project, in conjunction with all other mining activity, may further alter timing and location of traditional mule deer migration routes and may contribute to shifts in winter range use from the Dunphy Hills and the southern portion of the Tuscarora Range to the Izenhood and Sheep Creek ranges. The long-term significance of these potential shifts in winter range is not known.

Pronghorn antelope using the Boulder Valley would be subjected to additional stress from increased activity in the area, and from the necessity to avoid the proposed water conveyance canal. Some habitat would be lost due to construction of the canal. Loss of some pronghorn to drowning may occur. Though difficult to assess quantitatively, these impacts would contribute to a cumulative long-term loss in pronghorn numbers in the area.

Potential Mitigation and Monitoring Measures

Mitigation measures to offset predicted impacts to wildlife may include enhancement of offsite habitat as compensation for habitat loss due to unreclaimed areas associated with the Leeville Mine project. Direct impacts to mule deer through vehicle collisions could be reduced by implementing travel restrictions and reduced speed limits during peak migration times, in corridors where mule deer cross access roads.

The open canal segment of the groundwater conveyance system may cause disruption of pronghorn antelope movements and drowning of small mammals and reptiles. If the canal is fenced to keep livestock out of the canal, the fence should be designed to prevent wildlife from accessing the canal. Consideration should be given to providing one or two crossings (bridges) wide enough, and covered with soil and vegetation such that pronghorn antelope would use them. At a minimum, the canal liner should not be smooth plastic, but a fabric or substance that provides traction to animals falling into the canal. NDOW wildlife personnel have suggested a rock liner and slope of 5:1, rather than the proposed 3:1 smooth liner (Gray 2001; Lamp 2001).

Newmont would comply with the Migratory Bird Treaty Act by not conducting stripping operations during the breeding season (3/15-7/16) of ground nesting migratory birds using the area. If stripping is proposed during the breeding season, nest surveys would be conducted prior to disturbance and buffer zones would be used to protect identified nests.

The Sierra Pacific Power Company power line relocation should be constructed with predatory bird anti-perching devices on crossarms, tops of structures, above the crossing point of cross-braces, and either side of static wires, as needed.

Irreversible and Irretrievable Commitment of Resources

The Proposed Action describes reclamation of all disturbed areas to the extent that they would support wildlife habitat, domestic grazing, dispersed recreation, and mineral exploration and development. Reclamation methods would be employed that are technically effective, cost efficient, and require no post-reclamation maintenance to ensure continued performance. Disturbed surfaces would be re-established to support self-sustaining vegetation communities, control precipitation infiltration, and minimize erosion and sedimentation. A portion of rock faces associated with surface support facilities would not be reclaimed following cessation of mining. No wildlife resources would be irreversibly or irretrievably lost once reclamation has been completed. Wildlife diversity and population densities can be expected to recover to pre-disturbance levels over time.

Residual Adverse Impacts and Impacts of Mitigation

No residual adverse impacts to terrestrial wildlife are expected from the proposed Leeville Project. Impacts of mitigation measures described above would be positive.

THREATENED, ENDANGERED, CANDIDATE, AND SENSITIVE SPECIES

Summary

Direct impacts to threatened, endangered, candidate, and sensitive species or their habitat include incremental loss of habitat (including prey base) due to mine disturbance. Species with habitat potentially affected by the Project include goshawk, burrowing owl, sage grouse, Swainson's hawk, Preble's shrew, golden eagle, ferruginous hawk, and several species of bat (foraging and roosting habitat).

The magnitude of base flow reductions in area streams (e.g., Maggie, Marys, Beaver, and Boulder creeks and the Humboldt River) caused by adding Leeville dewatering to other dewatering operations in the Carlin Trend at any given time would be 0.1 cfs or less. Portions of three streams that support Lahontan cutthroat trout (LCT) (e.g., upper Coyote Creek, upper Little Jack Creek, and a mid-section of Beaver Creek) are within the predicted cumulative cone of depression in the Carlin Trend. Other stream segments and springs within the cumulative effects drawdown area support springsnails.

Impacts to threatened, endangered, candidate, and sensitive species from implementation of Alternatives, A, B, or C, would be similar to those described for the Proposed Action.

Direct and Indirect Impacts

The following subsections summarize potential direct and indirect impacts that would result from
the proposed Leeville Project and alternatives.

Proposed Action

Some animals could be caught in the open canal portion of the water discharge system between the proposed water treatment plant and the TS
Ranch Reservoir. The synthetic liner in the canal and velocity of the water could result in animals drowning.

Incremental loss of prey base would result from direct land disturbance totaling 486 acres for the Leeville Project. The Leeville Project is located adjacent to mine disturbance associated with Newmont's North Operations Area, the Lantern Mine, Section 36 Project, and Carlin Mine. These mine activities have resulted in displacing some animals and changing the characteristics of the prey base for other animals. The loss of 486 acres at the Leeville Project is not expected to further impact species that rely on the prey base in the Leeville Project Area.

Proposed dewatering activities at the Leeville Project would add approximately 20 years to the recovery period of the water table potentially being impacted by dewatering systems in the Carlin Trend. The extension to the recovery period would not result in new or different impacts to threatened, endangered, candidate and sensitive species beyond those predicted to occur as a result of current dewatering or recovery period.

Bald Eagle

Bald eagles are present in the vicinity of the Project as winter residents and seasonal migrants, usually associated with ice-free bodies of water. A few wintering bald eagles are present along the Humboldt River, attracted to open water and availability of prey (waterfowl and fish). Wintering bald eagles are mobile and readily move to new areas if prey becomes available. Bald eagles could be attracted to road kills (deer, rabbits) on haul roads.

Bald eagles are frequently killed while feeding on mule deer and rabbit carcasses on highways. This may account for up to 25 percent of the annual bald eagle mortality (Hazelwood 2000). To determine the potential impact, it is necessary to assess how many mule deer are killed on haul roads, and when. If mule deer are being killed while bald eagles are in the area, then there is a potential, though non-quantifiable problem. During winter months, when bald eagle numbers reach their peak, mule deer have migrated south to their winter range, and would likely not pose a problem on area mine roads. Road-killed rabbits occur on a year-round basis on highways or roads that are used by highway traffic.

Lahontan Cutthroat Trout

Because impacts to surface water currently occupied by LCT would not occur as a direct result of the Leeville Project, no measurable direct or indirect impacts to LCT are expected to occur. **Figure 4-2** depicts groundwater drawdown associated with the Leeville Project and the location of LCT habitat in the vicinity of the Leeville Project.

Preble's Shrew

Extension of the duration of dewatering impacts associated with the Leeville Project would extend the time period for potential loss of flow in some springs, seeps, and stream reaches within the areas of potential impact. This extension of impact could reduce the amount of suitable habitat for this shrew species (BLM 2000a). The direct loss of 486 acres of upland habitat due to mine disturbance may also reduce habitat for this species.

Sensitive Bat Species

Five sensitive species of bats have been identified as potentially occurring in the vicinity of the Leeville Project. Day and night roosts, hibernacula, and maternity roosts for these species would not likely be directly impacted by the Project. Potential impacts include loss of upland foraging habitat. Compared to the total amount of upland habitat available and the relatively poor foraging habitat it represents for bats, the impact to bats due to loss of upland habitat would be minimal.

Golden Eagle

Potential impacts to golden eagles are primarily associated with the direct loss of upland habitat for potential prey species. Because the amount of upland habitat lost during the life-of-mine is small compared to the amount of upland habitat available, and habitat would be reclaimed after mine operations cease, impacts to golden eagles would be minimal.

Direct loss of golden eagles may occur from collisions with vehicle on haul roads and other mine-related traffic. Losses may also occur from electrocution or collision with powerlines associated with mine facilities.

Osprey

No impacts to osprey are anticipated as a direct or indirect impact of the proposed Project as this species is rare in this area. Osprey would not be expected to roost or forage along smaller streams, springs, or seeps, in the area that might be impacted by the Project. No effects are expected to occur to Willow Creek Reservoir, where osprey habitat exists.

Northern Goshawk

Northern goshawks are not expected to be impacted by the Project directly. Indirect impacts to this species would correspond to any incremental loss of habitat for goshawk prey due to proposed mine disturbance, though these potential impacts are not likely to affect distribution and/or abundance of goshawks in northern Nevada.

Swainson's Hawk

The likelihood of Swainson's hawks nesting and foraging within the area impacted by the Leeville Project is low, based upon the species' current distribution in northern Nevada (BLM 2000a). A reduction in prey abundance and a loss of potential roosting habitat due to the direct loss of upland habitat would not likely impact the distribution and/or abundance of this raptor species in northern Nevada.

Ferruginous Hawk

The success of nesting raptors is often closely associated with the available prey base, and prey availability is particularly important to nesting ferruginous hawks (BLM 2000a). Reduction in upland habitat from direct mine disturbance could reduce potential prey base for ferruginous hawks, although mining activity bordering the proposed Leeville Project has already affected ferruginous hawk habitat in the area (BLM 2000a).

Burrowing Owl

Upland nesting, roosting, or foraging habitat of this species could be affected by the proposed Project. Construction and land disturbance activities would destroy any existing habitat inside the footprint of mine disturbance. The nearest known burrowing owl population is in the lower Boulder Valley (BLM 2000a).

Sage Grouse

Sage grouse may nest and forage in sagebrush/ grassland habitat affected by the Proposed Action. Incremental loss of this habitat may contribute to local declines in sage grouse populations. Some individuals could be lost from the population, but losses attributable to the Project would not likely affect viability of local populations. No known leks (courtship areas) or wintering areas would be affected by development of the proposed Project or alternatives.

Lewis Buckwheat

Lewis buckwheat is a small plant that is restricted to dry, open, relatively barren and undisturbed convex ridges and crests underlain by silicaceous carbonate and limestone rock types on all aspects (BLM 2000a). Typical habitat is characterized by sparse to moderately dense vegetation, including low sagebrush, rubber rabbitbrush, Indian ricegrass, and squirrel tail bottlebrush. A total of 33 populations are known to occur in an area north of Emigrant Pass and adjacent Marys Mountain. No known populations would be affected by the Proposed Action.

Columbia Spotted Frog

No direct or indirect impacts to Columbia spotted frog or its habitat are anticipated due to the Project.

Nevada Viceroy

Nevada Viceroy is associated with willows below 6,000 feet elevation. Predicted impacts to surface water flow that would affect maintenance of willow communities are not expected to reduce the amount and quality of habitat for this species. However, the delay in recovery of the water table as a result of the Leeville dewatering system would also delay recovery of willows in areas affected by existing dewatering.

California Floater

The Proposed Action is not predicted to cause any reduction in stream flow in stream reaches where the species has been documented, therefore, no direct or indirect impacts to California floaters are expected.

Springsnail

Springsnail populations are known to occur at six springs in upper Antelope Creek, one spring in upper Willow Creek, Warm Spring in Marys Creek basin, and Warm Billy Spring and Rattlesnake Spring in the Boulder Creek subbasin. No populations have been found in the Maggie Creek basin or the remainder of the area potentially affected by dewatering systems proposed for the Leeville Project.

Alternative A

Implementation of Alternative A would eliminate the potential for animals to be caught in an open canal and drown.

Alternative B and/or C

Implementation of Alternative B and/or C would have no measurable change on impacts to threatened, endangered, candidate, or sensitive species.

No Action Alternative

The No Action Alternative would not affect threatened, endangered, candidate or sensitive species from Leeville Mine activities. Impacts resulting from other mines and dewatering in the Carlin Trend would continue.

Cumulative Impacts

Potential cumulative impacts on threatened, endangered, candidate, and sensitive species as a result of dewatering activities at Leeville, South Operations Area, and the Goldstrike Property are addressed in the Cumulative Impact Analysis report prepared by BLM (2000a). This report indicates cumulative impacts could occur in Maggie, Susie, and Boulder creeks drainages and the Humboldt River due to dewatering activities of mines in the Carlin Trend. Habitat for California floaters, Columbia spotted frog, LCT and springsnails may be affected by addition of Leeville dewatering to existing dewatering operations in the Carlin Trend.

The magnitude of base flow reduction to area streams (e.g., Marys, Maggie, Beaver, and Boulder creeks and the Humboldt River)

resulting from the addition of Leeville dewatering to existing dewatering in the Carlin Trend is predicted to be 0.1 cfs or less for each stream or river segment identified above. A reduction of 0.1 cfs or less for flow in Maggie Creek is 2.7 percent of the mean October baseflow of 3.7 cfs in the creek as measured in Maggie Creek Canyon (USGS 2000). For combined mine dewatering in the Carlin Trend, predicted maximum reductions in flow for streams potentially affected by Leeville dewatering on a cumulative basis would be: Humboldt River = 8 cfs; Boulder Creek = 0.1 cfs; upper Maggie Creek = 0.8 cfs; and Marys Creek = 1.9 cfs (BLM 2000a) (see *Water Quantity and Quality* section of this chapter.

The potential reduction in base flow would not have a measurable effect on the amount of available foraging habitat for wintering and migrating bald eagles. Potential impacts would also be minimized because: 1) low numbers of bald eagles typically winter within the hydrologic study area (two to six bald eagles within each of Rock, Maggie, and Boulder creeks sub-basins); 2) wintering and migrating bald eagles use both upland and open water areas for foraging; 3) no drawdown effects are anticipated for the Willow Creek Reservoir, a prominent site for bald eagles; and 4) no known communal or historic roost sites occur within the hydrologic study area (i.e., area of potential groundwater drawdown) (BLM 2000a).

Surface water reductions within occupied LCT habitat could reduce aquatic habitat that supports LCT populations. A reduction of habitat quality or areal extent could result in decreased numbers of this species. However, the majority of occupied habitat in these drainages is located upstream of projected impacts. Therefore, viability of these isolated and self-sustaining LCT populations should be maintained (BLM 2000a), though reductions in available habitat may subject these populations to higher risk, and reduce the potential for recovery.

The modeled maximum extent of groundwater drawdown from cumulative mine dewatering in the Carlin Trend extends into two major drainages and their tributaries that support LCT populations; Maggie Creek and Rock Creek basins (**Figure 4-3**). Surface water impacts are not expected to extend into drainages that contain LCT within the upper Rock Creek Basin and, therefore, LCT populations in those tributaries would not be affected.

The 8-mile segment of Maggie Creek that could be affected by flow reductions, as predicted by cumulative hydrologic models, support individual LCT in scattered locations; but as of 2000, did not support a self-sustaining population. Flow reductions in this segment, however, could reduce the possibility of genetic interchange between existing populations in the basin (BLM 2000a). Impacts to surface water flow could last for about 250 years to reach equilibrium in the vicinity of the Leeville Project after cessation of dewatering in the Carlin Trend (BLM 2000a).

Main tributaries to Maggie Creek that contain LCT and are within the predicted cumulative cone of depression include portions of Coyote, Little Jack, and Beaver creeks. Genetic interchange among these populations and populations in Maggie Creek is limited by migration barriers (e.g., perched culverts) and lack of flow in the lower reaches of these streams. Consequently, individual populations are reproducing but remain isolated from populations in Maggie Creek as well as adjacent streams (AATA 1997; BLM 2000a, 2000c). Flow reductions in these reaches could further reduce potential for genetic interchange among these populations.

BLM (2000a) reported that sensitive bat species would also be adversely affected by cumulative dewatering activities in the Carlin Trend through degradation of foraging habitat associated with wetlands and riparian areas. Impacts to bats associated with the loss of springs, seeps, and stream reaches and associated riparian vegetation would be directly correlated with the magnitude of loss or alteration of these features. Newmont has committed to augment flow in springs, seeps, and streams as specified in the SOAP Mitigation and Monitoring Plan (BLM 1993b). Newmont has implemented a successful riparian restoration project that has improved riparian habitat and stream flows in the Maggie Creek drainage, improving bat foraging habitat (BLM 2000c).

Potential alteration or loss of springs, seeps, and riparian areas due to dewatering may reduce potential prey and impact golden eagles and ferruginous hawks through incremental loss of forage. Newmont has implemented a successful riparian restoration project that has improved riparian habitat and stream flows in the Maggie Creek drainage, improving golden eagle and ferruginous hawk foraging habitat over the short-term.

Potential long-term adverse impacts to northern goshawks could result from reduction or loss of upland and riparian habitats associated with perennial water sources. The majority of these areas, however, would not be impacted by the Project, including impacts from mine dewatering and drawdown. Possible impacts to nesting and foraging goshawks would be limited to upland and/or riparian areas that support suitable trees and vegetation for nesting and prey.

Potential impacts to springs, seeps, and stream reaches could potentially affect burrowing owls if they are dependent upon open water, which has not been documented. Potential impacts are expected to be minor.

Although sage grouse would not be affected by dewatering activities, loss of sagebrush habitat from mine development, wildfires, removal of sagebrush with herbicides, and livestock trampling and grazing are cumulatively interacting to reduce nesting, foraging, and brood-rearing habitat within the Carlin Trend. Throughout the range of the sage grouse, populations are generally declining, and populations are being lost from formerly occupied habitat. Loss or degradation of sage grouse habitat associated with the Leeville Project are expected to be minor, and would not substantially reduce local or regional sage grouse populations.

Columbia spotted frogs have not been documented within the predicted cumulative cone of depression associated with mine dewatering in the Carlin Trend. However, populations of spotted frogs have been found in tributaries to Maggie Creek whose headwaters lie within the cumulative cone of depression.

California floaters have been documented at the margin of the predicted cumulative cone of depression resulting from mine dewatering in the Carlin Trend. These locations are located along Maggie Creek (**Figure 4-3**).

Springsnails have been documented in six springs in upper Antelope Creek subbasin. These springs occur within the predicted cumulative cone of depression associated with mine dewatering in the Carlin Trend.

Potential Monitoring and Mitigation Measures

Appendix A of the Final EIS for Newmont's South Operations Area Project (BLM 1993a) is Newmont's Mitigation Plan for that project. This plan is currently being updated to address potential impacts associated with the South Operations Area Project Amendment. Surface water and groundwater monitoring plans and conditions that would trigger augmentation are described in the Maggie Creek Watershed Restoration Project document. A number of springs, seeps, and stream reaches that include those potentially impacted by dewatering from the Leeville Project, are monitored quarterly. If groundwater levels fall more than ten feet below the lowest level measured during the baseline year (1993) Newmont will initiate, within 14 days, consultation with BLM concerning possible augmentation of the spring group affected, and will increase monitoring to monthly. Other stipulations are described in the Mitigation Plan. Barrick also has a mitigation plan that includes monitoring a number of springs, seeps, and stream reaches. Some of these fall within the possible impact area of the Leeville Project. Details of their monitoring and mitigation plan are presented in Barrick's Draft Supplemental EIS for the Betze Project (BLM 2000b). As of early 2001, an NDOW representative observed that springs, seeps, or stream reaches within the Carlin Trend cumulative impact area have not been adversely impacted enough from drawdown to initiate mitigation and augmentation (Lamp 2001). See Potential Mitigation and Monitoring Plan in *Water Quantity and Quality* section in this chapter.

To minimize potential bald eagle mortality, it would be necessary to either minimize or prevent mule deer mortality on roads (through fencing, traffic speed restrictions, etc.) or require road kills to be immediately reported and

removed from the road. During winter months, when eagle numbers reach their peak, mule deer have migrated south to their winter range, and would not pose a problem in areas where haul truck traffic could encounter deer.

Sage grouse populations could be monitored and habitat enhancement/protection measures implemented to preserve or restore sage grouse habitat on the west side of the Tuscarora Range. Habitat enhancement actions could include contribution to habitat restoration projects currently underway and/or a grazing management plan within the T Lazy S Allotment that addresses sage grouse habitat.

Sierra Pacific Power Company power line relocation would be constructed with predatory bird anti-perching devices on crossarms, tops of structures, above the crossing point of cross-braces, and on either side of static wires, as necessary.

Irreversible and Irretrievable Commitment of Resources

With successful reclamation of disturbed areas, there would be no irreversible or irretrievable commitment of resources.

Residual Adverse Effects and Impacts of Mitigation

Successful implementation of mitigation described above would offset impacts. Impacts associated with mitigation activities could include ground disturbance if construction of mitigation measure (pipelines, and wells) necessary to provide flow to streams or springs are implemented.

GRAZING MANAGEMENT

Summary

The proposed mine site and pipeline are located entirely within the T Lazy S grazing allotment although only a portion of the Project area is currently open to grazing. The Proposed Action would result in a direct loss of 36 animal unit months (AUMs) on public land as a result of surface disturbance associated with the Project. Stocking rates on some allotments in the area may be reduced as a result of cumulative impacts of groundwater drawdown, which would reduce water availability, soil moisture, and associated plant productivity and diversity at some sites. Alternative water sources may be developed to compensate for these losses.

Impacts to grazing management resulting from implementation of Alternative A, B, and/or Alternative C would be similar to those described for the Proposed Action.

Direct and Indirect Impacts

Proposed Action

The Leeville Project, which would total 486 acres of disturbance, is located entirely within the T Lazy S Grazing Allotment. Most of the project area (453 acres) is on public land. The allotment is administered by BLM and has been decreasingly available for grazing due to increased mining activity.

The Proposed Action would result in loss of an estimated 36 AUMs on public land in the area currently open to grazing within the Project area. This includes direct loss of approximately 264 acres of surface vegetation in the area currently open to grazing. **Figure 2-**4 shows the current and proposed fencing alignment in the Project area. The associated stocking reduction on the T Lazy S Allotment of 36 AUMs is less than 0.3 percent reduction for that allotment.

Implementing the Leeville Project would not impact additional livestock water sources, but would extend the recovery period after dewatering ceases (see *Water Quantity and Quality* section in this chapter).

Alternative A, B, and C

Impacts to livestock grazing from implementation of Alternatives A, B, and/or C would be similar to those described for the Proposed Action. Reduction in surface disturbance (118 acres) associated with Alternative C would not affect grazing because this area is not currently open to grazing.

No Action

The No Action Alternative would not impact current grazing practices in the area. No ground disturbance would occur and stocking rates would continue at present levels.

Cumulative Impacts

The cumulative impacts area for grazing resources includes all or portions of the T Lazy S Allotment, the Twenty-Five Allotment, Marys Mountain Allotment, and the Carlin Field allotment. Portions of these allotments have previously been excluded from grazing, primarily in response to mining activity.

Reduction or loss of water flow in springs used by livestock resulting from dewatering activities at the Leeville Mine and other mines in the Carlin Trend could result in displacement of livestock and/or concentrating livestock at water sources not affected by dewatering. Sixteen of 28 water sources on the T Lazy S Allotment are potentially affected to some degree by regional groundwater drawdown in the area caused by all dewatering operations in the north Carlin Trend (BLM 2000a).

Groundwater drawdown resulting from mine-related dewatering activities in the area may affect various livestock watering sources, including improved springs, stock wells, springs, seeps, and perennial stream reaches. These impacts could vary from reduced flows to cessation of flow for a period of up to nearly 100 years. These potential impacts however, would not likely result in a reduction of AUMs within the Twenty-Five and Carlin Field allotments.

Increased irrigation within Boulder Valley would likely increase the areal extent of herbaceous wetlands and irrigated hay meadows within and adjacent to the floodplain, forage production and carrying capacity of these areas, and the availability of water for livestock use. Continued infiltration of discharge water into the TS Ranch Reservoir would continue to provide a water source to springs in the Boulder Valley.

Potential Mitigation and Monitoring Measures

Groundwater drawdown has the potential to impact area water sources. These sources should be monitored to evaluate impacts of drawdown on flow from these sources. Measurable reduction in flow would be compensated for by providing water in the same vicinity by alternative methods (water development or augmentation methodologies).

Shifts in livestock grazing habits resulting from dewatered springs has potential to impact other area water sources. Consequently, livestock distribution and allotment use patterns should be monitored. Development of new water sources in impacted areas could offset impacts.

Most areas disturbed by mine-related activities would be revegetated to restore and mitigate for vegetation lost.

Irreversible and Irretrievable Commitment of Resources

Grazing on mine-related disturbance areas would be lost until revegetation efforts and forage production are comparable to pre-mining levels associated with adjacent land.

Residual Adverse Effects and Impacts of Mitigation

Potential loss of available water sources resulting from groundwater drawdown may result in long-term reductions in carrying capacity on some allotments. Mitigation activities (e.g., fence construction, water development) would produce short-term local disturbance. Operation and maintenance of developed mitigation would consume energy and produce intermittent local disturbance.

RECREATION AND WILDERNESS

Summary

Dispersed recreation opportunities in the vicinity of the proposed Leeville Project have been restricted since the early 1980s due to intensified mining and exploration activities in the Carlin Trend. Addition of the Leeville Project would result in fewer acres available for recreational activities during operation and after cessation of mining until reclamation is complete. Most of the work force for facility construction and mining would be drawn from the local labor pool; consequently, impacts to existing campgrounds and other area recreational opportunities are expected to be minimal relative to existing conditions. Wilderness areas would not be impacted by the Proposed Action or Alternative A, B, and/or C.

Direct and Indirect Impacts

Proposed Action

Recreation

The Proposed Action, including construction of the mine dewatering system pipeline, would result in the incremental disturbance of 486 acres (453 public and 33 private). This area would not be available for recreation until mining and reclamation are completed. The Leeville Project area is not intensively used for recreation due to extensive mining and exploration activities in the surrounding area. Consequently, public access has been restricted for safety and security reasons. In addition, land within the proposed project vicinity does not offer unique outdoor recreation opportunities. Portions of the study area outside of the Carlin Trend active mining district, including land within BLM's Elko, and Winnemucca districts contain large areas of similar land available to the public for dispersed recreation.

Construction of mine facilities would require about 4 years. The labor force for mining operations is expected to peak at about 400 employees. Due to area mine closures and/or cutbacks, existing local labor force would be sufficient to provide workers during construction and mining phases of the project. Regional recreation opportunities, including campgrounds and other facilities, would be minimally impacted.

During the life of the Leeville Project and prior to completion of reclamation, the mine site and immediate surrounding area would be unavailable for hunting. Hunting opportunities in the area would be further reduced because big game species, such as pronghorn antelope and mule deer, would likely use alternate winter range and migration routes. Hunting opportunities outside the immediate project area and the North Operations Area may be adversely affected by additional mining activity and effects of localized dewatering on big game and game bird habitat. These impacts are discussed further in the *Cumulative Impacts* section of this chapter.

Wilderness

The nearest wilderness is over 50 miles away and the closest Wilderness Study Area (WSA) is over 25 miles away. Neither the wilderness or the WSA is expected to be directly impacted by the Leeville Project although high-intensity lighting associated with mining activity could affect the sense of solitude experienced by visitors to the WSA when the glow is visible. Glow from the Leeville Project would not be discernible from other existing light sources in the North Operations Area.

Alternatives A, B, and C

Effects on recreation and wilderness resources from implementation of Alternative A, B, and/or C would be similar to those described for the Proposed Action.

No Action Alternative

Under the No Action Alternative no additional disturbance to private or public land or direct impacts to recreation and wilderness resources would occur.

Cumulative Impacts

The cumulative impacts area evaluated for recreation and wilderness values includes northeastern Nevada. The gradual but continuous expansion of mining activities along the Carlin Trend would result in less area available for dispersed recreational activity. Any increase in population associated with expanding mining activity would result in more demand for recreation on public land. A Cumulative Impact Analysis report (BLM 2000a) predicted displacement or loss of animals, including big game species, upland game birds, and waterfowl in habitat located in areas affected by combined dewatering operations. These areas include riparian habitat, mule deer and pronghorn antelope seasonal ranges and transitional ranges, and to a lesser extent, big horn sheep range. These areas are within the predicted maximum drawdown area, which is illustrated in **Figure 4-3.** Decreased game animal density in areas where surface water sources are reduced or eliminated would diminish the appeal of the area to hunters.

Although the nearest wilderness area is over 50 miles away, increased night lighting associated with the combined effects of the various mining projects in the Carlin Trend would affect a person's sense of wilderness experience.

Potential Mitigation and Monitoring Measures

No mitigation or monitoring measures for recreation or wilderness have been developed by the BLM.

Irreversible and Irretrievable Commitment of Resources

Newmont has developed a reclamation plan in accordance with BLM and NDEP regulations to address disturbances associated with the Leeville Project. The objectives for reclamation are to support post-mining land use, including dispersed recreation activities. According to the Plan of Operations (Newmont 1997a), a portion of the rock faces associated with surface support facilities would not be reclaimed. Pre-mining land uses are expected to resume.

No irretrievable or irreversible impacts to wilderness areas or recreational uses within the study area are expected as a result of the proposed Project.

Residual Adverse Effects and Impacts of Mitigation

Residual effects on recreation resources may include withdrawal of land not reclaimed for future recreation opportunities or enhancements. The Proposed Action adds to the number of disturbed acreage in the vicinity; however, all but a small portion of the total disturbance would be reclaimed. No residual adverse impacts to wilderness areas are expected as a result of the Proposed Action.

ACCESS AND LAND USE

Summary

During the last two decades, land use in the Leeville Project area has changed from ranching and grazing to predominantly mining. Since the early 1980s, access to rangeland in the project area has been restricted due to concentrated mine exploration and development in the region. The Proposed Action would not affect existing rights-of-way for Barrick's communication site and access road, and Sierra Pacific Power Company's powerline along the North-South Haul Road. An amendment to an existing Sierra Pacific Power Company right-of-way allowing rerouting of approximately 3800 feet of existing powerline through the proposed mine area would be submitted to BLM for approval. Impacts to land use and access resulting from implementation of Alternative A, B, and/or C would be the same as those described for the Proposed Action.

Direct and Indirect Impacts

Proposed Action

Existing rights-of-way for Barrick's communication site (N-54682) and access road (N-48045), and Sierra Pacific Power Company powerline along the North-South Haul Road (N-46957) would not be affected by the Proposed Action. Rerouting approximately 3,800 feet of an existing Sierra Pacific Power Company powerline within the proposed mine area would require an amendment to right-of-way N-47775. Newmont would submit an application for amendment to BLM for approval. Existing access into the Project area is controlled by Newmont and Barrick and would not be affected by the Proposed Action.

Alternatives A, B, and C

Direct and indirect impacts to land use and access from implementation of Alternative A, B, and/or C would be similar to those described under the Proposed Action. Impacts to public access within the Project area and immediate vicinity would be similar to those described for the Proposed Action.

No Action Alternative

The No Action Alternative would result in no additional impacts to land use and access.

Cumulative Impacts

The cumulative impacts geographic area evaluated for land use and access encompasses roads and public land access in and adjacent to the Carlin Trend extending from the Emigrant Springs Project area to the Hollister Mine.

As mining continues to develop along the Carlin Trend, more land would be removed from public access for use by mining activities. Water uses would be affected where mine dewatering causes significant changes in groundwater levels, surface water flow, and/or water quality.

With the exception of rock faces, highwalls, and open pits, restoration of land surface disturbed by mining to post-mining land uses would eventually result in reestablishing land use and access similar to pre-mining levels.

Potential Mitigation and Monitoring Measures

No mitigation or monitoring for land use or access has been developed by BLM.

Irreversible and Irretrievable Commitment of Resources

Except for portions of rock faces near the surface support facilities, all disturbed areas would be
reclaimed. Pre-mine land uses including wildlife habitat, dispersed recreation, and grazing, are expected to resume following reclamation.

Residual Adverse Effects and Impacts of Mitigation

No residual adverse effects to land use activities are expected following reclamation of the Leeville Project area. Portions of the rock faces that are not reclaimed may restrict, to a minor degree, vehicle and foot access to a limited area at the mine site.

NOISE

Summary

The Leeville Project would result in an increase and or continuation of current noise levels generated by mining and ore-processing activities in Newmont's North Operations Area and South Operations Area. Noise generated would not impact residential areas. Noise impacts resulting from implementation of Alternative A, and/or B would be the same as those described for the Proposed Action. Noise would be generated during backfilling of shafts under Alternative C.

Direct and Indirect Impacts

Proposed Action

The major sources of noise from the Leeville Project would be loading of waste rock and ore, and truck haulage. Surface equipment including haul trucks and loaders currently used in Newmont's mining operations would be used at the Leeville Project. Noise generated from the Proposed Action would not impact residential areas. Potential impacts of noise on wildlife are discussed in the *Terrestrial Wildlife* section of this chapter.

Alternatives A, and B

Under Alternative A, B, and C, no significant change in the degree of noise is expected to occur from normal mining operations or from pre-mining construction activities. Since the Leeville Project's life-of-mine would extend beyond the projected life-of-mines for current mining operations in the vicinity, noise from the Leeville Project would result in extending the duration of noise generation in the Carlin Trend.

Alternative C

Noise would be generated during backfilling of shafts under Alternative C.

No Action Alternative

Under the No Action Alternative, impacts from noise would not change from current levels.

Cumulative Impacts

As mining continues to develop along the Carlin Trend, noise would continue to be generated from mining and processing activities as well as changes in the location of noise sources through 2020.

Potential Mitigation and Monitoring Measures

No mitigation or monitoring measures for noise beyond those required by the Mining Safety and Health Administration (MSHA) have been identified by the BLM.

Irreversible and Irretrievable Commitment of Resources

No resource would be irreversibly or irretrievably impacted by noise generated from the Leeville Project.

Residual Adverse Effects and Impacts of Mitigation

There would be no residual adverse effects on the environment from the noise generated during mining and ore-processing operations. When mining activity ceases, anthropogenic noise would be reduced to low levels associated with reclamation (recontouring and seeding) and then cease altogether.

VISUAL RESOURCES

Summary

Visual impacts of the Proposed Action and Alternatives were analyzed using procedures set forth in the Visual Resource Contrast Rating Handbook (BLM 1986b). Changes in landscape from the Proposed Action and Alternatives are compared with the characteristic landscape to determine the degree of contrast in form, line, color, and texture. If the degree of contrast does not meet the Visual Resource Management (VRM) System objectives, the Project should be redesigned or mitigation measures proposed. As noted in Chapter 3, most of the Project site is located on VRM class IV land, which allows the greatest degree of modification of the landscape by management activities. Implementation of Alternative A would eliminate the canal segment of the water discharge pipeline system. Reclamation of the pipeline corridor would eliminate visual contrast associated with an open canal. Impacts resulting from implementation of Alternative B and/or C would be similar to those described for the Proposed Action.

Direct and Indirect Impacts

Proposed Action

The primary impact of the Proposed Action would be large-scale modification of landforms. Angular, blocky forms and horizontal lines would create moderate contrasts with the natural rounded, rolling hills and ridges of the characteristic landscape. These contrasts would be weaker where existing facilities would be expanded. KOP locations used to evaluate visual impacts and VRM class boundaries are shown on **Figure 3-18**.

Land clearing and construction of waste rock disposal facilities would expose soil and rock material in a variety of colors ranging from light grayish tan to reddish tan to very dark gray. Contrast between these colors and those existing in the landscape would range from moderate in bright sunlight and when front lighted, to weak in overcast conditions and when back lighted.

Clearing vegetation from mine facility areas would create weak to moderate color contrasts with the existing landscape. New lines would be introduced delineating edges of cleared areas and some change in texture would be seen, but overall contrast would be weak. Visual impacts from new structures would be small when compared with visually dominant waste rock disposal sites and mine pits in adjacent mine areas.

When viewed from KOP1, the Proposed Action would offer weak contrasts with the existing landscape (**Figure 4-5**). The waste rock facility would dominate the view. Much of the topsoil stockpile and part of the refractory ore stockpile areas would be obscured by the waste rock disposal facility. Bold, angular forms, vivid color hues, and rough textures would be introduced by the Proposed Action. These would be similar in appearance to existing, adjacent mining facilities visible from KOP1.

From KOP2, the Turf ventilation shaft area and headframe would be visible in the foreground, creating moderate to strong contrasts in form, line, and color (**Figure 4-5**). The refractory ore stockpile and waste rock disposal facility would introduce weak to moderate contrasts in form, line and color with the existing landscape. Bold, trapezoidal forms and horizontal lines would be introduced by the waste rock disposal facility, creating weak to moderate contrasts with the existing landscape. Exposure of unweathered soil and rock would create moderate contrasts in color with the characteristic landscape.

All facilities associated with the Proposed Action would be visible in the middleground and background from KOP3 (**Figure 4-5**). The waste rock disposal facility and the refractory ore stockpile would introduce blocky, trapezoidal forms which would create moderate contrasts with the existing landscape. To the east, views of headframe structures would offer weak to moderate contrasts in form, line, and color. The dewatering pipeline corridor would be visible in

the distance to the west. This facility would introduce weak contrasts in line and color with the existing landscape. Visual impacts of the Proposed Action could be perceived as an extension of the existing mining operations adjacent to the Project site.

Reclamation would reduce visual contrast associated with the Proposed Action (**Figure 4-6**). Residual visual impacts, however would be permanent.

Alternative A

Elimination of the canal segment of the water discharge pipeline system and reclamation of the pipeline corridor would eliminate visual impacts as seen from KOP1 and KOP2 (**Figure 4-5**). Major structures offering moderate to strong contrasts with the existing landscape would be eliminated.

Alternative B and/or C

Implementation of Alternative B and/or C would have no effect on the extent of visual impacts of the Proposed Action.

No Action Alternative

Under this alternative no visual impacts would occur at the Leeville Mine site beyond those already present.

Cumulative Impacts

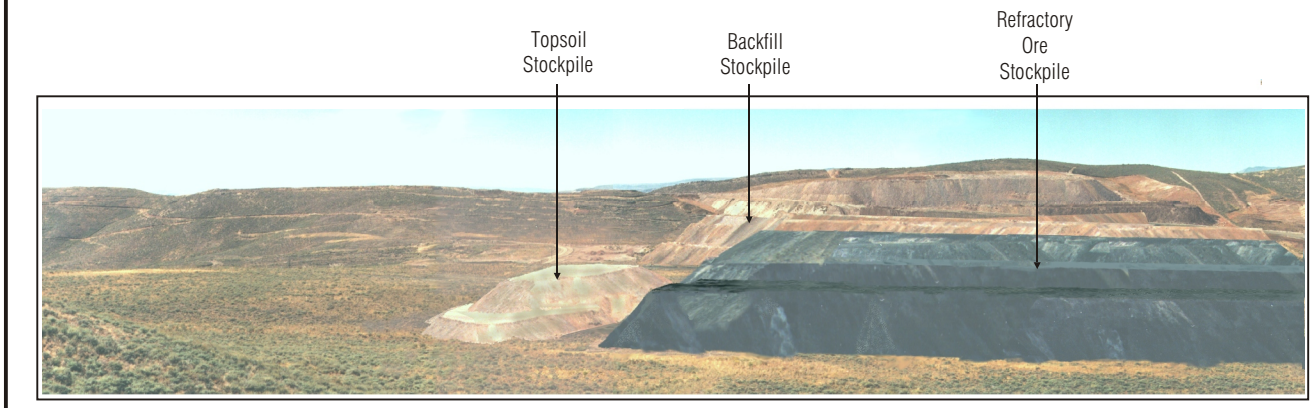
Reclamation measures are required and would occur on current and future mining activities in the Carlin Trend. However, major elements of certain mining facilities would remain, including pit highwalls and earth-fill structures. Visual contrasts in form, line, and color would remain in the post-mining landscape.

VRM Class IV allows management activities that result in major modification to the character of the landscape. Impacts on visual resources from reasonably foreseeable mining activities can be minimized, but not eliminated, through reclamation measures. To continue to meet VRM Class IV objectives, all feasible measures should be taken to minimize visual impacts. It is possible to regrade earthen structures to reflect existing forms, lines, colors, and textures. Recla-mation grading can achieve a stable post-mining configuration by rounding angular features and flattening side slopes. Modifying the flat top surface of earthen structures and developing variable sideslopes can help reduce visual contrasts created by horizontal lines and trapezoidal forms.

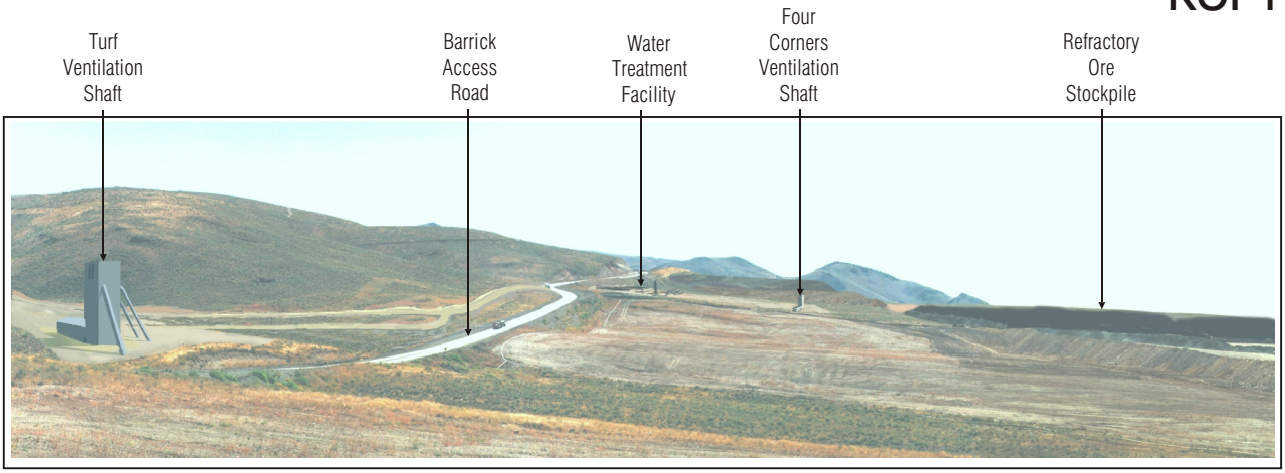
Potential Mitigation and Monitoring Measures

Mitigation measures have been developed to minimize visual impacts. The objective is to reduce visual contrasts based on three concepts: (1) siting of facilities in less visible areas; (2) minimizing disturbance; and (3) repeating basic elements of form, line, color, and texture. Photographic simulations of the reclaimed Leeville site as seen from KOP1, KOP2, and KOP3 are shown in **Figure 4-6.** In addition to measures included in the Proposed Action, the following measures could be applied to minimize visual impacts of the Proposed Action and alternatives:

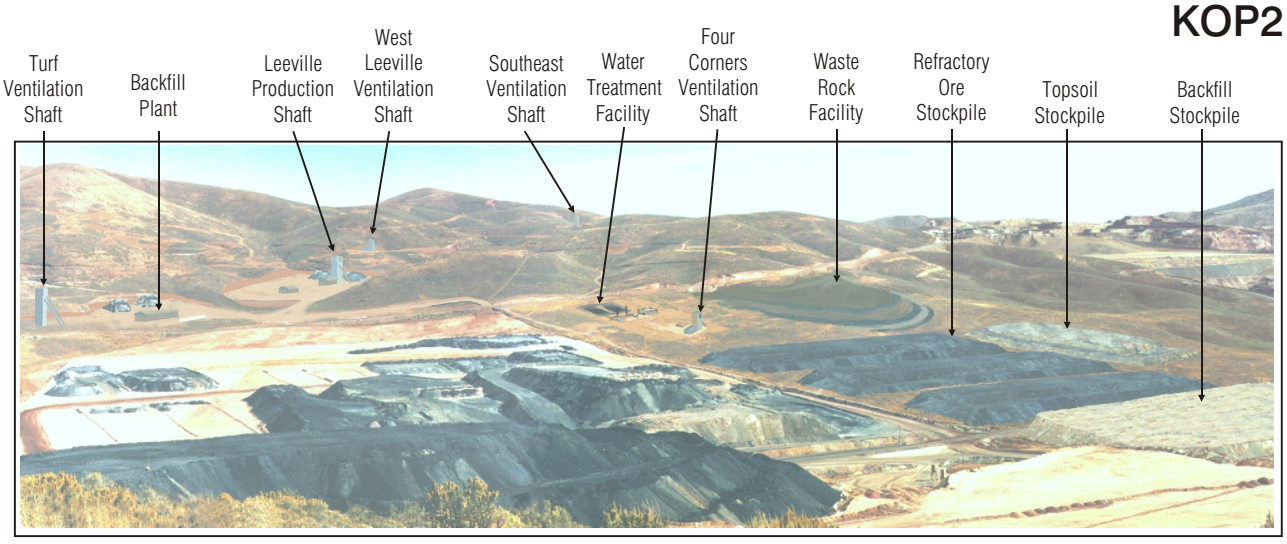
- Slope gradients on embankments (between 3H:1V and 2.3H:1V) could be varied to create diversity of form and reflect the naturally rolling, rounded forms of the existing topography;
- Edges of embankments could be rounded to reduce the angular appearance and soften edges;
- Clearly defined construction limits should be established. Construction limits should use irregular shapes that reflect existing forms and patterns;
- Revegetation should be planned so colors and textures blend with undisturbed lands;
- Visual contrast of structures with natural forms could be minimized by using colors that blend with the land rather than the sky and using finishes with low levels of reflectivity; and
- Painting structures a slightly darker color than the surrounding landscape could compensate for the effects of shade and shadow.



KOP1



KOP2



KOP3

Proposed Mining Conditions
Leeville Project
FIGURE 4-5

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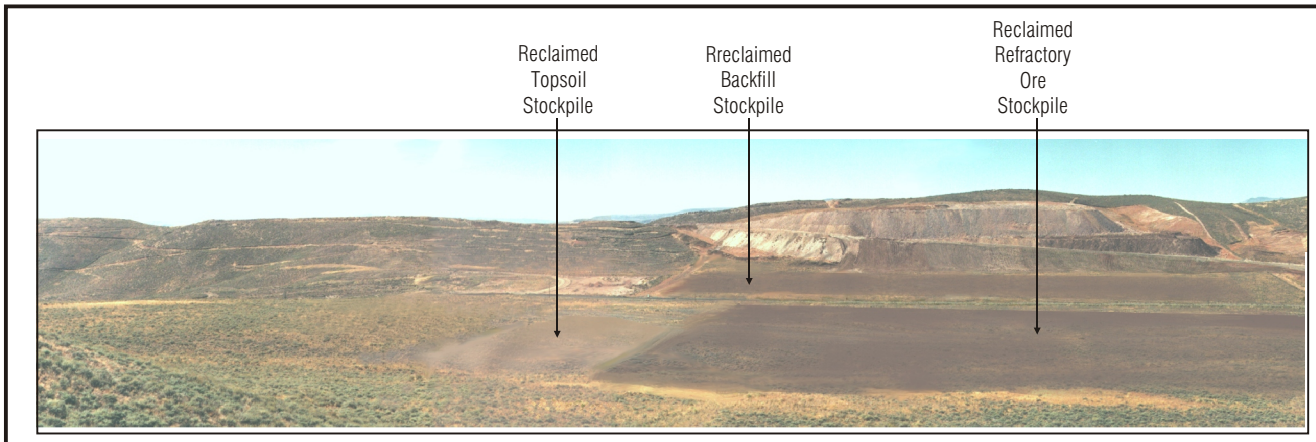
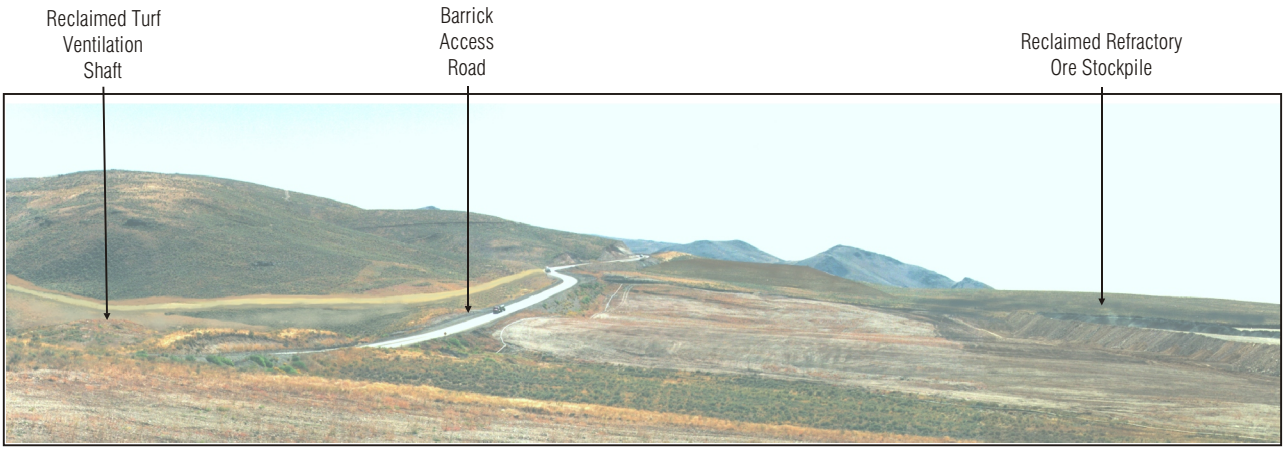


KOP1



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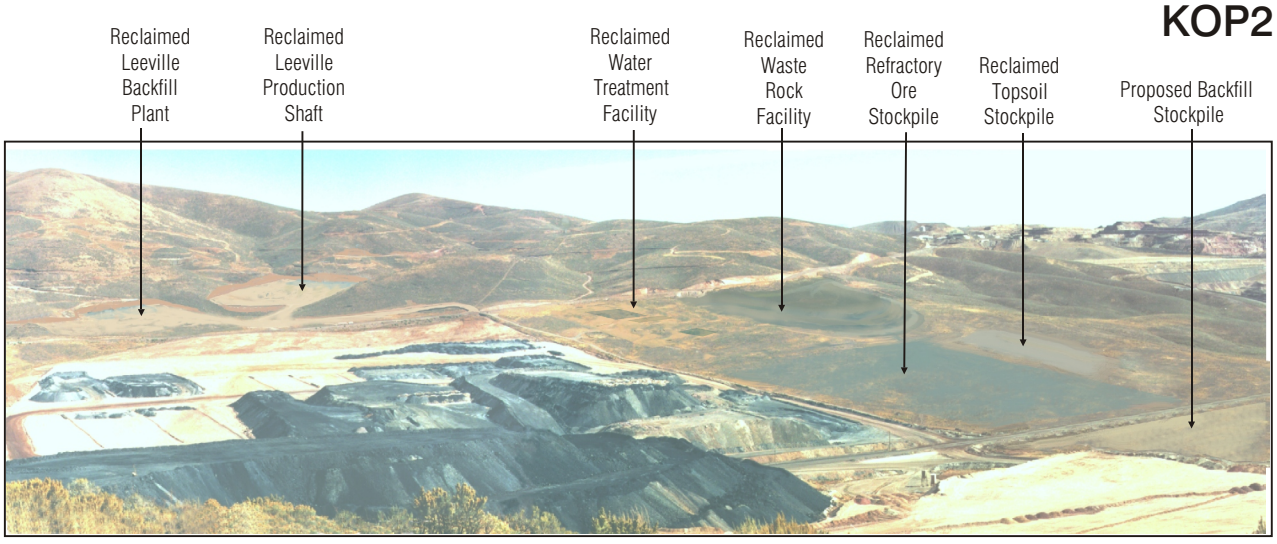

KOP3

Reclaimed Conditions
Leeville Project
FIGURE 4-6

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Irreversible and Irretrievable Commitment of Resources

An irretrievable commitment of visual resources would occur during construction and active mining period until reclamation is successful. Impacts on visual resources would be reduced through implementation of reclamation and mitigation measures. Unreclaimed rock faces would represent an irreversible commitment of resources.

Residual Adverse Effects and Impacts of Mitigation

Following successful reclamation, the waste rock disposal facility would be the most noticeable residual adverse effect of the Proposed Action **Figure 4-6**). Weak contrasts in form, line and color could remain. Weak contrasts would result from the prismoidal forms and straight lines of the reclaimed waste rock disposal embankments. Finer and more uniform soil in this area would also create weak contrasts in texture with the existing landscape. Rock faces associated with the Leeville Project disturbances adjacent to Rodeo Creek would remain visible after reclamation as weak contrast associated with straight lines and color.

Implementation of mitigation measures would further reduce visual impacts. No adverse impacts are anticipated to result from mitigation.

CULTURAL RESOURCES

Summary

*The Area of Potential Effect associated with the Leeville Project takes into consideration effects to properties eligible for listing on the National Register of Historic Places. For purposes of this assessment the Area of Potential Effect has been divided into two sub-areas. The Area of Direct Effect is the area where potential surface disturbance or occupancy would occur as described in the Proposed Action and Alternatives. The Surrounding Area of Effect lies outside the Area of Direct Effect and may be subject to impact although no surface disturbance is proposed **(Figure 3-20)**. For example, some resources may be impacted due to introduction of visual or audible intrusions.*

Implementation of the Proposed Action or Alternatives would not impact any property determined eligible or potentially eligible to the National Register of Historic Places. The Proposed Action and Alternatives would result in the loss of cultural resources that are not eligible to the National Register of Historic Places. However, these properties have been recorded to BLM standards and that site information has been integrated into local and statewide data repositories.

Direct and Indirect Impacts

Proposed Action

Thirty-one cultural resources are located within the Area of Direct Effect, none of which are eligible or potentially eligible to the National Register of Historic Places. One site (CrNV-01-10801), a multi-component prehistoric site located in the Surrounding Area of Effect near the proposed dewatering pipeline and canal system, has been determined eligible to the National Register based on Criterion D. Construction of the proposed pipeline and canal system would not disturb this site. No impact would occur to this property as a result of the Proposed Action.

Some 306 cultural resources have been identified in the Surrounding Area of Effect. The BLM has determined that 22 of these resources are eligible for listing on the National Register; one additional resource is identified that "may be eligible." Of the eligible and potentially eligible properties, two are considered significant based on a National Register eligibility criterion other than D. An historic period mine complex (CrNV-01-10842), and, a historic period debris scatter (CrNV-01-12466), both are considered eligible based on criteria A and D.

CrNV-01-10842 is a large complex of placer mining sites that extend over a mile along a drainage on the east side of the Tuscarora Mountains. Most historic period activities occurred along drainage bottoms, but some isolated prospect features are located at the head of a drainage or canyon that affords a view to the west (into the Project area). Some Project facilities would be visible from those isolated prospects. The southeast ventilation shaft would be about one-half mile from the nearest such prospect, while other visible Project elements (ore and aggregate stockpiles) would be more distant (about 2 miles away). Facilities associated with the production shaft would not be visible due to an intervening hill. Existing unimproved roads and an electrical transmission line are located between the isolated prospects and the proposed Project area. Therefore, it is unlikely the Proposed Action would have any additional impact to the setting or general integrity of CrNV-01-10842 that has not occurred previously.

CrNV-01-12466 is also located in a drainage bottom along the east slope of the Tuscarora Mountains. The property is about 2 miles from the nearest proposed Project facility. None of the proposed Project facilities would be visible from CrNV-01-12466. Therefore, the Proposed Action would not have an impact to the setting or general integrity of CrNV-01-12466.

Based on currently available resource information, the Proposed Action would not have the potential to impact the integrity of National Register eligible properties located in the Surrounding Area of Effect.

Alternatives A, B, and C

Impacts resulting from implementation of Alternative A, B, and/or C would be similar in nature and magnitude to those described for the Proposed Action.

No Action Alternative

Impacts on Cultural Resources resulting from implementation of the No Action Alternative would be similar to existing conditions in the Leeville Project area.

Cumulative Impacts

Activities associated with the Leeville Project would result in an improved level of access into the Project area and the surrounding area as well. Improved access and increased traffic volumes would contribute to increased activity (intentional and casual) at cultural resource locations. There is a potential for impacts to occur to resources due to these activities.

Potential Mitigation and Monitoring Measures

The Proposed Action would not have a direct impact on National Register eligible properties located in the Area of Direct Effect, nor indirect impact on eligible properties located in the Surrounding Area of Effect.

Irreversible and Irretrievable Commitment of Resources

The Proposed Action and Alternatives would result in the loss of 31 cultural resources that are not National Register eligible. Their loss would constitute an irreversible and an irretrievable commitment of a resource. However, these resources have been recorded to BLM standards and site information has been integrated into local and statewide data repositories.

Residual Adverse Effects and Impacts of Mitigation

There would be no residual adverse effect to cultural resources as a result of the Proposed Action and Alternatives.

NATIVE AMERICAN RELIGIOUS CONCERNS

Summary

Consultation with the Newe/Western Shoshone occurred in two phases. Phase I involved consultation concerning proposed areas of disturbance associated with the Leeville Project. The Newe/Western Shoshone did not identify any religious or traditional cultural properties within the proposed Project area. Phase II of the consultation concerned potential cumulative impacts to Newe/Western Shoshone religious and traditional areas that could occur as a result of the cumulative effects of groundwater dewatering.

Implementation of the Proposed Action or Alternatives would have no direct or indirect impacts on Newe/Western Shoshone traditional cultural values, practices, properties, or human remains.

Direct and Indirect Impacts

Proposed Action

Consultation between BLM and the Newe/Shoshone has been ongoing since May 1997 (see **Appendix A**). There have been no religious or traditional values, practices, human remains, or cultural items identified in the Project area as a result of consultation.

Deaver (1993) made the following conclusions in an ethnographic report regarding the general region:

- There are no apparent uses of the direct impact area for spiritual or ceremonial purposes;
- Cultural properties within the area of the proposed project do not appear to qualify as traditional cultural properties; and
- The Leeville Project area is within the traditional territory of the Newe/Western Shoshone, and within the boundary of land covered by the Treaty of Ruby Valley. Although specific properties or areas of concern have not been identified within the Project area, many Newe/Western Shoshone traditionalists maintain that they never ceded their traditional land and that they retain jurisdiction over public domain in this area. In the traditional worldview, disturbances such as mining disrupt the flow of *Puha* (spiritual power) and lead to a dissipation of spirit life and degradation of sacred spring water. Some traditional values associated with the land are irreplaceable. However, reintroducing native plants and animals as part of the reclamation plan can reduce the magnitude of that loss.

Alternatives A, B, and C

Impacts resulting from implementation of Alternative A, B, and/or C would be similar in nature and magnitude to those described for the Proposed Action.

No Action Alternative

Selection of the No Action Alternative would result in no further direct or indirect impacts on Native American religious or traditional values, practices, properties, human remains or cultural items.

Cumulative Impacts

The Proposed Action would not have a direct impact on Native American religious or traditional values, practices, human remains, or cultural items. However, some Newe/Western Shoshone have expressed a concern that cumulative impacts may occur to their spiritual life and cosmology. The Proposed Action would contribute to groundwater drawdown over some area, potentially impacting stream, spring, and seep flows. Associated changes would occur to vegetation patterns and wildlife distribution. Such changes, individually and collectively, could impact the integrity of power spots, disrupt the flow of spiritual power (*Puha*), and cause the displacement of spirits (e.g., little men and water babies). Any such impact would limit the potential of Newe/Western Shoshone to participate in traditional religious activities. The potential for such an effect is of concern to some Newe/Western Shoshone because impacts associated with groundwater drawdown would be interwoven, and the resultant disruption of spirit forces could occur over a wide area.

Given that religious or traditional values, practices, human remains, or cultural items were not identified by the Newe/Western Shoshone in the Project area, and the Project is predicted to have limited direct impact on groundwater conditions, BLM has determined the potential for a cumulative impact to Native American traditional values is minimal. Effects resulting from mine dewatering would be temporary. Models indicate a 90 percent recovery of the water table about 30 years following cessation of dewatering associated with the Leeville Project. Springs and seeps near the Project affected by dewatering should begin to recover once dewatering operations cease.

Potential Mitigation and Monitoring Measures

No direct or indirect effects on Newe/Western Shoshone traditional cultural values, practices, properties, or human remains are anticipated in the Leeville Project area as a result of the Proposed Action or Alternatives. Therefore, mitigation or monitoring measures are not proposed.

Irreversible and Irretrievable Commitment of Resources

Consultation with the Newe/Western Shoshone has not identified specific spiritual or religious resources in the Project area. As a result, the Proposed Action and Alternatives would not cause an irreversible or irretrievable commitment of any such resource. Impacts to identified traditional cultural properties would not occur due to the Proposed Action or Alternatives.

Residual Adverse Effects and Impacts of Mitigation

Consultation with the Newe/Western Shoshone has not identified specific spiritual or religious resources in the Project area. As a result, no residual effects would occur to such resources as a result of the Proposed Action or Alternatives.

SOCIAL AND ECONOMIC RESOURCES

Summary

Temporary contract workers would be hired for the construction phase of the Leeville Project. Approximately 300 construction workers would be employed during Year 1, decreasing to 200 in Year 2, 150 in Year 3, 100 in Year 4, and 50 by Year 5 (Coxon 1997). Newmont anticipates 400 workers would be needed during the operational phase of the Project. A majority of operational personnel would be hired from the existing mine-related work force in the Carlin Trend.

Positive impacts that would occur under the Proposed Action and Alternatives would be continued direct employment in the mining industry and secondary employment in the retail and service sectors in the study area; income generated from wages earned by workers at the Leeville Project and by secondary job employees within the study area communities; and property taxes and net proceeds of mining taxes paid by Newmont for the Leeville mining operation collected by local and state jurisdictions. Negative impacts would be minimal because only a small number of construction and operational workers are expected to be hired outside the local labor area. The low market price of gold over the past year has resulted in a slow-down of growth in the area and, in turn, more housing is available in the area and community services are less stressed.

Under the No Action Alternative, the Leeville Project would not be approved. Since most of the work force for the Leeville Project would come from the existing mine-related work force in the Carlin Trend, negative impacts under the No Action Alternative would include increased unemployment, reduced wages spent in the local economy, decreased revenues to local and state jurisdictions, increased stress on public assistance programs, and decreased quality-of-life of some residents.

Direct and Indirect Impacts

Proposed Action

Impacts to socioeconomic resources occur if a large number of workers and their families move into the study area as a result of jobs either directly or indirectly created by mine development and operation. Since a relatively low number of employees outside the study area would be needed for construction and operation activities, few people are expected to move into the area due to the Leeville Project. Therefore, negative impacts to socioeconomic resources such as community services, housing, and social well-being would be minimal.

Economic impacts during operational phases of the project would include continued employment in the mining industry and secondary jobs in retail and service sectors. Most property taxes and net proceeds of mining taxes would be paid to Eureka County, whereas most sales tax revenue would accrue to Elko County. Commercial and resi-dential development induced by mine expansion would increase revenue from property and sales taxes. Opportunities generated by construction and operation of the proposed Leeville Project would positively affect quality-of-life for workers and their families.

Dewatering activities associated with Leeville Project would result in removal of 360,000 acre-feet of groundwater from the water resource. These activities are predicted to have a slight direct effect (0.05 cfs) in reducing base flow conditions in a portion of Beaver Creek. Leeville Project dewatering would also extend the duration of dewatering and would delay recovery of existing cones-of-depression in the Carlin Trend.

Predicted reductions in groundwater levels as a result of the Proposed Action would not directly impact stockwater sources, irrigation practices, and other commercial and individual activity in the long-term.

Alternatives A, B, and C

Impacts on socioeconomic resources in the study area under Alternative A, B, and/or C would be similar to those described for the Proposed Action.

No Action Alternative

Negative socioeconomic impacts under the No Action Alternative, due to decreased mining employment, would include increased unemployment, reduced wages spent in the local economy, decreased revenues to local and state jurisdictions, increased stress on public assis-tance programs, and decreased quality-of-life of some residents. Less stress on community services would be a positive impact under the No Action Alternative.

Cumulative Impacts

The socioeconomic cumulative impacts study area includes areas potentially impacted by mine water management activities in the Carlin Trend and other activities that discharge or consume water. This study area includes the towns of Carlin, Palisade, and Dunphy, Nevada and the Humboldt River Basin (downstream to the Humboldt Sink) (BLM 2000a).

Lowered groundwater levels in the Carlin Trend due to continued and expanded dewatering activities at Betze/Post, Gold Quarry, and Leeville mines could affect domestic, irrigation, livestock, industrial, and/or commercial water uses. Decreased water levels may impose additional costs to well owners for increased costs associated with deepening an existing well, drilling a new well, and purchase of new pumps.

Reduced flow in springs resulting from the groundwater cone of depression could adversely affect the availability of water for livestock and wildlife. This would result in socioeconomic impacts to livestock owners and reduced econ-omic benefits derived from wildlife-associated recreation in the area. If the availability of stock water is reduced, grazing permittees may need to locate other pastures for livestock grazing and/or decrease livestock numbers (BLM 2000a). Decreased flow in springs that support the domestic water supply of the town Carlin also could be impacted by increased dewatering in the Carlin Trend.

Irrigation and livestock watering are the primary water uses in the Humboldt River Basin. If discharge of additional mine water to the over-appropriated Humboldt River is authorized by the State Water Engineer, it could have a temporary beneficial effect on irrigation use by water right holders in the basin. There is a possibility that increased flow may cause more

water to be in contact with irrigation structures on a year-round basis, causing more damage to structures and making repairs to structures more difficult. After cessation of mining, flow in the Humboldt River would decline to below pre-mining conditions, gradually recovering over a period of more than 100 years. Potential reductions in base flow of the river would impact agricultural operations, especially during low-flow periods, by limiting late season irrigation and livestock watering.

In spite of recent downturn in the value of gold, a construction work force remains located in Elko and Eureka counties. Depending on timing of construction activities at the proposed Leeville Project and other new mine or mine expansion developments, it may be possible for the existing construction work force to satisfy construction labor demands of these projects. If construction activities were to occur simultaneously at future projects, substantial numbers of new construction workers may be needed.

Increased numbers of construction workers mov-ing into the area would not create a problem because excess housing is currently available in the Elko area. If in-migration of workers exceeds current housing, stress on local community services and recreation areas could occur.

Potential Mitigation and Monitoring Measures

BLM's Cumulative Impacts Analysis report (BLM 2000a) presents a comprehensive analysis of cumulative impacts resulting from dewatering operations at Leeville, Goldstrike Property and Gold Quarry mines. Section 9.0 of that document provides a qualitative evaluation of potential effects to social and economic conditions from existing and proposed mining operations within the study area. Because of the complex interrelationships of surface and groundwater variables; soil composition, geologic, climatological, and geochemical variables, all of which are influential of hydrologic impacts, it is not possible, with any degree of certainty, to identify the extent or degree to which social and economic impacts might occur. However, mitigation measures discussed in Chapter 3.2 (BLM 2000a), have been designed, specifically, to ameliorate and alleviate potential economic impacts of the Proposed Action. It is, therefore, not expected that any economic losses would be sustained. Potential economic impacts have been identified and are addressed as part of the analysis in Section 9.0 (BLM 2000a). No mitigation or monitoring of social and economic resource impacts beyond those described in the Cumulative Impact Analysis (BLM 2000a) or the Leeville Plan of Operations have been identified.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible and irretrievable commitment of socioeconomic resources associated with the Leeville Project.

Residual Adverse Effects and Impacts of Mitigation

No residual adverse effects are expected.

ENVIRONMENTAL JUSTICE

SUMMARY

Direct and indirect impacts associated with the Proposed Action and Alternatives would not have a disproportionate affect on minority populations. Two low-income populations have been identified in the study area. Neither population would receive a disproportionate impact from implementation of the Proposed Action and Alternatives.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Direct and indirect impacts associated with the Proposed Action and Alternatives would not have a disproportionate affect on minority populations in the study area.

Two groups are present in the study area that qualify as low-income populations based on EPA guidelines (1998). As of 1990, nearly 40 percent of Whites and all Asians in Census Tract 9516.01 (located north of Carlin along the Eureka/Elko County line) lived below the poverty threshold. They represent disproportionately large populations when compared with the county or the state as a whole.

Impacts associated with the Proposed Action are identified in other sections of this chapter. None of those impacts would be "adverse" since they would not negatively affect human health or cause a significant environmental impact (none would cause an established threshold to be exceeded). Most impacts would be minor, and temporary or incremental in nature. With cessation of mining, most resource conditions are expected to return to pre-mining condition. Based on results of scoping and public meetings, representatives of the White and Asian populations in Census Tract 9516.01 have not expressed a concern that impacts are unacceptable, or above generally accepted norms. Based on these findings, the Proposed Action would not cause environmental justice impacts to low-income populations within Census Tract 9516.01.

Use of an area by minority or low-income populations for subsistence hunting and gathering can be an important consideration during assessment of environmental justice impacts. Data are not present in BLM files that would suggest the Project area has been used by a minority or low-income population in the recent past for procurement of subsistence resources. Further, no such information was developed during Native American consultation activities (see **Appendix A**). As a result, the Proposed Action would not have an affect on subsistence patterns important to a minority or low-income population.

Alternatives A, B, and C

Environmental justice impacts associated with Alternative A, B, and/or C would be the same as those described for the Proposed Action.

No Action Alternative

Impacts relating to environmental justice would not occur under the No Action Alternative.

Cumulative Impacts

The cumulative effects area for environmental justice includes census tracts 9601, 9506, 9507.02, and 9516.01. When viewed in the context of past and reasonably foreseeable projects, there would be no cumulative environmental justice effects as a result of the Proposed Action or Alternatives.

Potential Mitigation And Monitoring Measures

In the absence of identified environmental justice impacts, mitigation is not necessary.

Irreversible and Irretrievable Commitment Of Resources

There would be no irreversible or irretrievable environmental justice impacts as a result of the Proposed Action or Alternatives.

Residual Adverse Effects and Impacts of Mitigation

Implementation of the Proposed Action or alternatives would not result in residual adverse environmental justice effects.